

**VA Nebraska – Western Iowa  
Health Care System  
Grand Island, NE**

**Domestic Hot Water System Upgrade  
Grand Island, NE**

**May 9th, 2016**

**ALTUS PROJECT NO: 20322  
VA PROJECT NO: 636-14-113**



**DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS**

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**SECTION 00 01 15**  
**LIST OF DRAWING SHEETS**

The drawings listed below accompanying this specification form a part of  
the contract.

<u>Drawing No.</u>	<u>Title</u>
0-0	COVER SHEET
P0-1	BUILDING 1, BASEMENT, AREA 1 PLUMBING PLAN
P0-2	BUILDING 1, BASEMENT, AREA 2 PLUMBING PLAN
P0-3	BUILDING 1, BASEMENT, AREA 3 PLUMBING PLAN
P0-4	BUILDING 1, BASEMENT, AREA 4 PLUMBING PLAN
PG-1	BUILDING 1, GROUND FLOOR, AREA 1 PLUMBING PLAN
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P1-1	BUILDING 1, LEVEL 1, AREA 1 PLUMBING PLAN
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P6-5	BUILDING 1 PLUMBING RISER DIAGRAMS Q1-Z1
P6-6	BUILDING 1 PLUMBING RISER DIAGRAMS V2-E3
P7-1	BUILDING 3 LOWER & 1ST LEVEL PLUMBING PLAN
P8-1	BUILDING 5 LOWER & 1ST LEVEL PLUMBING PLAN
P9-0	PLUMBING GENERAL NOTES & DETAILS
P9-1	PLUMBING SYMBOLS & SCHEDULES
E0-4	BUILDING 1, BASEMENT, AREA 4 ELECTRICAL PLAN
E1-0	ELECTRICAL SYMBOLS & SCHEDULES

- - - END - -

**SECTION 01 00 00  
GENERAL REQUIREMENTS**

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Project 636-14-113, Correct Domestic Water Deficiencies at the Grand Island Veterans Affairs Medical Center (hereafter, Medical Center) as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Contracting Officer's Representative (hereafter, COR).
- C. Offices of ALTUS ARCHITECTURAL STUDIOS, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer (CO) or his duly authorized representative (COR).
- D. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- E. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present. Training:
1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and other relevant competency training. All employees of the contractor or subcontractors acting in a supervisory capacity shall have the 30-hour OSHA certified Construction Safety Course.
  2. Submit training records of all such employees for approval before the start of work.
- F. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this section

**STATEMENT OF BID ITEM(S)**

BASE BID ITEM, GENERAL CONSTRUCTION: Correct Domestic Water Deficiencies at Grand Island facilities below:

1. Per Drawings and specifications the contractor shall install hot water temperature and other water chemistry monitoring devices that report back to the existing Energy Management Control System. Balancing of hot water recirculating system. Install mixing

valves/faucets/scald proof devices on all hot water discharge locations throughout building 1, 3 and 5 of the Nebraska Western Iowa Health Care System.

- A. AFTER AWARD OF CONTRACT, specifications and drawings will be furnished to the contractor in electronic PDF format. Up to three printed sets of the drawings and specifications will be provided if requested by the contractor. Drawings will be provided in AUTOCAD DWG format if requested by the contractor.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense, from the electronic files provided.

#### **CONSTRUCTION SECURITY REQUIREMENTS**

##### A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

##### B. Security Procedures:

1. **Badge Requirements:** General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.

- a. **Local ID (Minimum ID Requirement for All Employees Performing Work Under this Contract):** All employees of the contractor and subcontractor(s) must display a VA issued badge (Local ID), with photograph, at all times on Medical Center property. Local IDs allow employees access to public areas of the Medical Center and the construction area, only.

- (1) Employees of the contractor and subcontractor(s) shall provide two forms of identification (See Appendix C, this section) and a completed VA NWIHCS Police Service Fingerprint Request Form (See Appendix A, this section) to the COR not less than seven days prior to the employee starting work at the Medical Center. The COR will schedule an appointment with the VA NWIHCS Police Service for the employee to be fingerprinted and issued a Local ID. Employees shall not be allowed to work on Medical Center property until Local ID has been issued.
- (2) All employees of the contractor and subcontractor(s) shall be fingerprinted by the VA NWIHCS Police Service. Fingerprints

shall be forwarded to and kept on file by the VA Office of Personnel Management in Washington, D.C.

**b. Non-PIV Identity Card (Required for Employees Acting in a Supervisory Capacity and/or Requiring a VA Issued Key):** Employees of the contractor and subcontractors acting in a supervisory capacity and maintaining a sustained presence on site shall be designated "responsible persons" and shall require a VA issued Non-PIV Identity Card, which shall be displayed at all times when on Medical Center property. Additionally, this job requires access to secure areas within the Medical Center. Contractor shall submit the name(s) of responsible person(s) who shall be issued government key(s).

- (1) Employee(s) of the contractor or subcontractor(s) designated as responsible person(s) shall provide two forms of identification (see Appendix C, this section) and a completed VA NWIHCS Police Service Fingerprint Request form (See Appendix A, this section) to the COR, who will initiate a request for a VA identification for the designated employee(s). Documents shall be submitted to the COR and designated employees shall be fingerprinted by the VA NWIHCS Police Service not less than 15 calendar days prior to designated employees starting work at the Medical Center.
- (2) Designated employee(s) requiring a VA issued Non-PIV Identity Card shall agree to be fingerprinted by the VA NWIHCS Police Service, have their fingerprints forwarded to and maintained on file by the VA Office of Personnel Management, have their name and fingerprints shared with local law enforcement agencies, and undergo a background investigation ("Special Agreement Check") conducted by the VA Human Resources department. The Special Agreement Check shall be completed and VA identifications shall be issued to designated employee(s) before designated employee(s) will be allowed to work on Medical Center property.
- (3) At least one responsible person designated by the contractor and approved by the COR or CO shall be present at all times when employees of the contractor or subcontractor(s) are working on Medical Center property.

c. Local IDs and Non-PIV Identity Cards shall be valid for six months from the date of issue. The contractor shall be responsible for ensuring all employees requiring access beyond the six month

period renew badges and identification cards before they expire. Badge/ID card renewal shall be scheduled with the VA NWIHCS Police Service through the COR not less than 15 calendar days prior to the ID card expiration. Failure to renew badges/ID cards before the end of their valid period may result in employees losing access to the Medical Center until a new badge/ID card application has been completed and approved, and a new badge/ID card issued. Costs and liabilities associated with delays caused by failure of the contractor's and subcontractor(s)' employees to maintain a current badge/ID card shall be born solely by the contractor.

- d. All employee information provided to the VA to meet the requirements of this section is protected by the Privacy Act of 1974. The VA follows the requirements of the Privacy Act, which protects personal information that the VA maintains in "systems of records". Information provided to the VA may not be disclosed unless permitted pursuant to 38 CFR 1.500 - 1.599. Records provided to and maintained by the VA may not be altered or destroyed, except as authorized by 38 CFR 1.579.
- e. Keys and identification cards shall remain the property of the government, and shall be returned to the government at contract completion, when the employee's presence is no longer required at the Medical Center, or when requested by the COR or CO. Contractor shall reimburse the government for the replacement cost of any keys or government issued identification cards lost or damaged as a result of negligence or malicious act by employees of the contractor or subcontractor(s).

- 2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give not less than 3 days' notice to the COR or Contracting Officer. This notice is separate from any notices required for utility shutdown described later in this section.
- 3. No photography of VA premises is allowed without written permission of the Contracting Officer.
- 4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

**B. Key Control:**

- 1. The General Contractor shall provide duplicate keys and lock combinations to the COR for the purpose of security inspections of

every area of project including tool boxes and parked machines and take any emergency action.

2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

C. Document Control:

1. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
2. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
3. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
4. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

D. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted to the COR (verbally, via e-mail, or in writing) 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Separate permits shall be issued for General Contractor and its employees for parking in designated areas only.

**FIRE SAFETY**

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):
  - a. E84-2008.....Surface Burning Characteristics of Building Materials
2. National Fire Protection Association (NFPA):
  - a. 10-2006.....Standard for Portable Fire Extinguishers

- b. 30-2007.....Flammable and Combustible Liquids Code
  - c. 51B-2003.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
  - d. 70-2007.....National Electrical Code
  - e. 241-2004.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
3. Occupational Safety and Health Administration (OSHA):
- a. 29 CFR 1926.....Safety and Health Regulations for Construction
- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a written plan detailing project-specific fire safety measures, including periodic status reports, and submit to the COR for review in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. All employees of the contractor and subcontractor(s) shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements prior to performing any work on Medical Center property. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. The contractor shall document this training for all contractor and subcontractor employees, and provide documentation to the COR or CO if requested.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities (such as trailers, storage sheds, and dumpsters) from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
- 1. Install and maintain temporary construction partitions as shown on the construction drawings to provide smoke-tight separations between construction areas and adjoining areas. Where only dust separation is required, as shown on the drawings, install minimum 6-mil fire-retardant polystyrene barrier sheeting, rated and clearly marked by the manufacturer. Where used, polystyrene sheeting shall be fully supported from the floor to the ceiling using tension rods and spreader bars, with tension rods placed with not more than six feet between them and, at minimum, at all corners and edges. All edges shall be sealed to prevent the passage of dust.

2. Where required, as shown on the drawings, install fire-rated temporary construction partitions to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures. Construct partitions of 5/8" Type X gypsum board on both sides of galvanized steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with the COR.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with the COR. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.
- K. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.
- L. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with and obtain permits from the COR at least 24 hours prior to commencing hot work operations. Hot work

permits are valid for 24 hours only; separate permits shall be required for each day of hot work operations. Hot work permits shall be maintained and kept on file by the contractor for the duration of the project.

- M. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to the COR.
- N. Smoking: Smoking is prohibited in all buildings and within 30 feet of any facility entrance on Medical Center property.
- O. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- P. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

#### **OPERATIONS AND STORAGE AREAS**

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer or the COR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as shown on the drawings and as determined by the COR.

- E. Workmen are subject to rules of the Medical Center applicable to their conduct.
- F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.
- G. Execute work so as to interfere as little as possible with normal functioning of the Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by the COR.
1. Do not store materials and equipment in other than assigned areas.
  2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to the Medical Center areas required to remain in operation.
  3. Where Medical Center personnel do not require access to vacated portions of the building(s), storage of Contractor's material and equipment will be permitted subject to fire and safety requirements.
- H. Phasing: To insure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to Contracting Officer/COR and Contractor, as shown on the contract drawings.
- K. Buildings will be occupied during performance of work. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment.

Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

L. Utilities Services: Maintain existing utility services for Medical Center at all times.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of the COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
2. Contractor shall submit a request to interrupt any such services to the COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the Resident Engineer.
4. In case of a contract construction emergency, service will be interrupted on approval of Resident Engineer. Such approval will be confirmed in writing as soon as practical.

M. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

N. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.

2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Resident Engineer.

O. Coordinate the work for this contract with other construction operations as directed by the COR. This includes the scheduling of traffic and the use of roadways, as specified in Article 1.16, USE OF ROADWAYS.

#### **ALTERATIONS**

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:

1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered.
2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and the COR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of the COR to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS"

C. Re-Survey: Seven days before expected partial or final inspection date, the Contractor and Resident Engineer together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:

1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and,

will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.

D. Protection: Provide the following protective measures:

1. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
2. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

#### **INFECTION PREVENTION MEASURES**

A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Not less than 30 days prior to the start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:

1. The RE and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement

corrective measures to restore proper pressure differentials as needed.

2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.

D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.

1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Resident Engineer. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
2. Do not perform dust producing tasks within occupied areas without the approval of the COR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
  - a. Provide dust proof temporary construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Resident Engineer and Medical Center.
  - b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
  - c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.

- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

**E. Final Cleanup:**

- 1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
- 2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
- 3. All new air ducts shall be cleaned prior to final inspection.

**DISPOSAL AND RETENTION**

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
  - 1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in

specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center property.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

**PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site scheduled to remain and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

**RESTORATION**

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of

the Resident Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Resident Engineer before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES"
- E. As-Built Drawings
  - A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
  - B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the Resident Engineer's review, as often as requested.
  - C. Contractor shall deliver two approved completed sets of as-built drawings to the Resident Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Resident Engineer.
  - D. Paragraphs A, B, & C shall also apply to all shop drawings.

#### **USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on Medical Center property.

**TEMPORARY USE OF EXISTING ELEVATORS**

A. Use of existing freight elevator (Elevator 5) for handling building materials and Contractor's personnel will be permitted subject to following provisions:

**TOILETS**

A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

**AVAILABILITY AND USE OF UTILITY SERVICES**

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The Contractor shall carefully conserve any utilities furnished without charge.

**INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals shall be provided to the COR as required by ARTICLE 1.19, PROJECT CLOSEOUT, this section.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the Resident Engineer and shall be considered concluded only when the Resident Engineer is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the Resident Engineer, does not

demonstrate sufficient qualifications in accordance with requirements for instructors above.

**RELOCATED ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the Resident Engineer.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".

**PROJECT CLOSEOUT - CONTRACTOR SUBMITTALS:**

- A. Phased Projects: Within 30 calendar days of the completion (beneficial occupancy by the Government) of each project phase, and prior to requesting final payment for that contract phase, the Contractor shall submit a single printed copy of all installation, equipment, material, system, warranty, testing, and certification documents as required by the various sections of these specifications.
  - 1. Each phase submittal shall be organized into three major divisions
    - a. Manufacturer Data and O&M Manuals
    - b. Test and Certification Reports
    - c. WarrantiesDocuments in each division shall be collated by specification section (Master Format 2004 (MF04)).
  - 2. In addition, the contractor shall provide a comprehensive list, in table form, of all installed equipment and controls, that shall include the following information for each piece of installed equipment:
    - a. Equipment Category
    - b. Equipment Name
    - c. Equipment Manufacturer
    - d. Date of Manufacture
    - e. Date of Installation
    - f. Model Number
    - g. Serial Number
    - h. Location Installed (e.g., room number (or closest room number for equipment installed in corridors), floor mounted, wall mounted, ceiling mounted, above ceiling, etc.)

3. The phase submittal shall also include a comprehensive list of all sub-contractors involved in that phase of the project, a summary of the work each sub-contractor completed, and a contact name, phone number, e-mail, and street address for the contractor and each sub-contractor.

4. Each phase submittal shall be provided in an indexed (with index tab dividers) three-ring binder. Binder shall be white, not less than 1" and not greater than 3" spine width, appropriately sized for the documents provided, and labeled with the VA Project Number and Name, Contract Number, Phase Number, and Date on the front cover and spine.

B. Electronic Submittal: Within 30 calendar days of project completion (beneficial occupancy by the Government of all contract phases) and prior to requesting final payment, the Contractor shall provide to the COR two (2) copies of a single, indexed (by specification section, Master Format 2004 (MF04)), searchable, electronic PDF document containing all installation, equipment, material, system, warranty, testing, and certification documents as required by the various sections of these specifications.

1. Electronic document shall be organized into three major divisions:

- a. Manufacturer Data and O&M Manuals
- b. Test and Certification Reports
- c. Warranties

Information in each division shall be collated and indexed by specification section (Master Format 2004 (MF04)).

2. The electronic submittal shall include a comprehensive list, in table form, of all installed equipment and controls, that shall include the following information for each piece of installed equipment:

- a. Equipment Category
- b. Equipment Name
- c. Equipment Manufacturer
- d. Date of Manufacture
- e. Date of Installation
- f. Model Number
- g. Serial Number
- h. Location Installed (e.g., room number (or closest room number for equipment installed in corridors), floor mounted, wall mounted, ceiling mounted, above ceiling, etc.)

3. Electronic submittal shall include PDF floor plans with annotated locations of all installed equipment and controls.

4. Electronic submittal shall include a list of all sub-contractors involved in the project, a summary of the work completed by each sub-contractor, and a contact name, phone number, e-mail, and street address for the contractor and each sub-contractor.

5. Electronic submittal shall include a list of training required by the various specification sections, the date training was provided, the name of the company employing the trainer, and the trainer's name and position title.

a. Training certificates shall be provided for all training provided by the Contractor and Subcontractors and shall include:

(1) A brief description of training provided, including the equipment or system that was the subject of training.

(2) The name of the company employing individuals providing training.

(3) The name and position title of the individuals providing training.

(4) A list of training attendees.

All training certificates shall be signed by the Contractor's Representative (Project Superintendent or Project Manager) and the COR prior to submittal.

6. Electronic submittal shall be provide on CD or DVD media, with case, and labeled with the VA Project Number and Title, Contractor Business Name, and Address.

C. Printed Submittal: Within 30 calendar days of project completion (beneficial occupancy by the Government) the contractor shall provide three (3) printed copies of all the information provided in the electronic submittal. Printed copies shall be provided in indexed (with index tab dividers) three-ring binders, and shall be organized in the same manner as the electronic submittal. Binders shall be white, not less than 1" and not greater than 3" spine width, appropriately sized for the documents provided, and labeled with the VA Project Number and Name, Contract Number, Phase Number, and Date on the front cover and spine.



**NWIHCS VA POLICE SERVICE  
FINGERPRINT REQUEST FORM**



NAME (Last, First, Middle): \_\_\_\_\_

SOCIAL SECURITY NUMBER: \_\_\_\_\_

DATE OF BIRTH (YEAR/MONTH/DAY): \_\_\_\_\_

ALIAS (MAIDEN NAME): \_\_\_\_\_

GENDER: \_\_\_\_\_ RACE/ETHNIC BACKGROUND: \_\_\_\_\_

EYE COLOR: \_\_\_\_\_ HAIR COLOR: \_\_\_\_\_

HEIGHT: Feet: \_\_\_\_\_ Inch: \_\_\_\_\_ WEIGHT: Lbs: \_\_\_\_\_

PLACE OF BIRTH (STATE OR FOREIGN COUNTRY) \_\_\_\_\_

CURRENT STREET ADDRESS: \_\_\_\_\_

CITY, STATE, POSTAL CODE: \_\_\_\_\_

CITIZENSHIP: \_\_\_\_\_

OCCUPATION: \_\_\_\_\_

EMPLOYER / SCHOOL AFFILIATION \_\_\_\_\_

**AGENCY USE ONLY BELOW THIS LINE**

TO BE COMPLETED BY HUMAN RESOURCES OR SPONSORING SERVICE

**INDIVIDUAL'S VA STATUS:**

FULL TIME VA EMPLOYEE	<input type="checkbox"/>	PART TIME VA EMPLOYEE	<input type="checkbox"/>	WITH OUT COMPENSATION (WOC)	<input type="checkbox"/>
AFFILIATING TRAINEE (STUDENT)	<input type="checkbox"/>	AFFILIATING FACULTY	<input type="checkbox"/>	CONTRACT EMPLOYEE	<input type="checkbox"/>
ASSIGNMENT OVER 120 DAYS		YES	<input type="checkbox"/>	NO	<input type="checkbox"/>
PROVIDES DIRECT PATIENT CARE		YES	<input type="checkbox"/>	NO	<input type="checkbox"/>
COMPUTER ACCESS REQUIRED		YES	<input type="checkbox"/>	NO	<input type="checkbox"/>

**VA POLICE USE ONLY**

IDENTITY VERIFICATION

DRIVERS LICENSE NUMBER: \_\_\_\_\_ STATE OF ISSUE: \_\_\_\_\_

OR

PASSPORT NUMBER: \_\_\_\_\_ COUNTRY OF ORIGIN: \_\_\_\_\_

FINGERPRINTS CONDUCTED BY: \_\_\_\_\_ DATE COMPLETED: \_\_\_\_\_

The VA Police conducts fingerprinting in Omaha and Lincoln. Fingerprinting in Omaha is on a walk in basis Mondays-Fridays from 8:00 - 11:30 a.m. and Noon - 4:00 p.m. in the Main Hospital Room B804. For assistance or questions please call 995-5818. In Lincoln fingerprinting must be scheduled with Sgt. Mike Kardell at 402-489-3802 Extension 6641. In Grand Island fingerprinting is conducted by Human Resources, to schedule

CONTRACTOR PERSONNEL: FOR THE OMAHA AND LINCOLN FACILITIES SEND THE COMPLETED FORM TO CONTRACTING AT Building C, Room 101. FOR THE GRAND ISLAND FACILITY SEND THE COMPLETED FORM TO HR.

**BACKGROUND INVESTIGATION REQUEST FORM-  
CONTRACT PERSONNEL**

Type of Investigation Request: Low Risk (NACI)

(Position Description Record located in Master File in Contracting)

Fingerprints Completed: \_\_\_\_\_ (VA Police Staff Initials)

Location of VA where applicant will work:  Omaha  Lincoln  GI

APPLICANT INFORMATION	
First Name	
Middle Name/Initial (if none, identify)	
Last Name	
Phone Number	
Title	
Department	
Social Security Number	
Date of Birth (MM/DD/YYYY)	
Place of Birth (city, state, country)	
U.S. Citizen (Yes/No)	
E-mail address	
COMPANY INFORMATION	
Contracting Company Name	
Contracting Company POC (HR or Security)	
POC Phone Number	
POC E-mail	
Street Address	
City	
State, Zip Code	
CONTRACT INFORMATION	
COTR	
Contract Number	

\*\*\*Please fax completed form to the VA Nebraska-Western Iowa Health Care System, Omaha Division, Contracting Office at 402-449-0612, or hand carry to Bldg. C, Room 101\*\*\*

If you have any questions, please contact the Contracting Office at 402-995-4780

**NOTE: PLEASE COMPLETE THIS FORM ASAP -  
COMPLETION REQUIRED PRIOR TO START OF CONTRACT**

February, 2011

## PIV IDENTITY DOCUMENTATION CRITERIA

The following criteria must be met by all VA employees, contractors, and affiliates prior to being issued a PIV card, or Non-PIV Card.

FIPS 201-1, Section 2.2 states the applicant shall be required to provide two original forms of identity source documents. The identity source documents must come from the list of acceptable documents included in *Form I-9, OMB No. 1115-0136, Employment Eligibility Verification*. At least one document shall be a valid State or Federal government-issued picture identification (ID).

**Table of Accepted Identification (From Form I-9)**  
**Last Update: January 7, 2008**

<b>Picture ID From Federal or State Government</b>	<b>Non-Picture ID or Acceptable Picture ID not issued by Federal or State Government</b>
<ul style="list-style-type: none"> <li>• State-Issued Drivers License</li> <li>• State DMV-Issued ID Card</li> <li>• U.S. Passport (unexpired or expired)</li> <li>• Military ID Card</li> <li>• Military Dependent's card</li> <li>• US Coast Guard Merchant Mariner card</li> <li>• Foreign Passport with appropriate stamps</li> <li>• Permanent Resident Card or Alien Registration Card with a photograph (INS Form I-151 or I-551)</li> <li>• ID Card issued by federal or state government agencies provided it includes a photograph.</li> </ul>	<ul style="list-style-type: none"> <li>• Social Security Card</li> <li>• Certified Birth Certificate</li> <li>• State Voter Registration Card</li> <li>• Native American Tribal Document</li> <li>• Certificate of U.S. Citizenship (INS Form N-560 or N-561)</li> <li>• Certificate of Naturalization (INS Form N-550 or N-570)</li> <li>• Certification of Birth Abroad Issued by the Department of State (Form FS-545 or Form DS-1350)</li> <li>• Permanent or Temporary resident card.</li> <li>• ID Card issued by local government agencies provided it includes a photograph or includes the following information: name, date of birth, gender, height, eye color, and address</li> <li>• Non-photo ID Card issued by federal or state government agencies provided it includes the following information: name, date of birth, gender, height, eye color, and address</li> <li>• School ID with photograph</li> <li>• Canadian Drivers License</li> <li>• US Citizen ID Card (Form I-179)</li> </ul>

## PIV IDENTITY DOCUMENTATION CRITERIA

1. Two forms of identification are required from the above list of acceptable documents. Either of the following is accepted:
  - a. Two forms of identification from the left column (Federal or State Government issued picture ID).
  - b. One form of identification from the left column (Federal or State Government issued picture ID) and one form from the right column (Non-Picture ID or Acceptable Picture ID not issued by Federal or State Government).
  
2. The following rules apply for form identification:
  - a. Any form of identification used for ID proofing may not be expired (except U.S. Passport)
  - b. VA PIV Cards are federally issued ID cards and can be used as a valid form of identification.
  - c. Handwritten or photocopied documents are not accepted.
  - d. An ID issued before a legal name change (e.g. birth certificate or driver's license) can be presented as one form of ID if a legal document (e.g. marriage certificate/license or a court order) is also presented linking the previous name to the current legal name. The linking document has to display both the former and current legal names. Both documents must be valid and not expired (except U.S. Passport). For example, a married woman may use both a certified copy of her birth certificate displaying her maiden name and a driver's license displaying her married name as the 2 forms of ID compliant with PIV Guidelines, as long as she provides a marriage license displaying both her maiden name and married name.
  - e. The Applicant's name listed on the VA PIV Registration Portal, Request for One-VA Identification Card, must match the name on one of the IDs presented by the Applicant.

- - - END OF SECTION 01 00 00 - - -

**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Post submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect/Engineer, and action thereon will be taken by Project Manager on behalf of the Contracting Officer.
- 1-6. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format using Submittal Exchange, a website service designed specifically for transmitting submittals between construction team members.
  - A. Submittal Preparation - Contractor may use any or all of the following options:

- B.
    - 1. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange website.
    - 2. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
    - 3. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
  - C. Contractor shall review and apply electronic stamp or signature certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
  - D. Contractor shall transmit each submittal to Architect using the Submittal Exchange website, [www.submittalexchange.com](http://www.submittalexchange.com).
  - E. Architect/Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review by Architect/Engineer and approval by Project Manager.
  - F. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES of the GENERAL CONDITIONS.
- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect/Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect/Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
- A. The electronic submittal process is not intended for color samples, color charts, or physical material samples. Submit physical samples required by mail or delivery in quadruplicate. Each physical submittal should be accompanied/ recorded with a digital submittal through Submittal Exchange, noting a physical item was submitted for review, a

list of physical items submitted, and representation as best possible of items submitted (electric format of color charts and photos or images of color samples or material samples). Accompanying digital submittal should contain all pertinent product literature. Physical submittals should only be accompanied by Contractor's transmittal letter. Both physical and digital transmittal letter should be the same.

- B. Both digital and physical submittals will receive consideration only when covered by a transmittal letter signed or stamped by Contractor. Letter shall contain the list of items, name of Medical Center , name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
  - 1. A copy of the letter must be attached to each submittal either physical or digital.
  - 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center , name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
  - 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. Not used.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter. Re-submittals should include all previously approved material.
- E. Approved physical samples will be kept on file by the Project Manager at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are

not requested for return by Contractor will be discarded after completion of contract.

F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped or signed by Contractor certifying to such check.

1. For each drawing required, submit legible electronic reproducible (PDF).
2. Electronic reproducible (PDF) shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings electronically via Submittal Exchange.
6. Not used.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted under one cover.

1-10. Physical samples shall be submitted for approval to:

Mike Hamilton  
Altus Architectural Studios  
12925 West Dodge Road  
Omaha, NE 68154

1-11. Not used.

1-12. Not used.

1-13. General Contractor shall include the full cost of Submittal Exchange project subscription in their proposal. This cost is to be included in the Contract Amount. Contact Submittal Exchange at 1-800-714-0024 to verify cost prior to bid.

A. At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.

B. Internet Service and Equipment Requirements:

1. Email address and Internet access at Contractor's main office.

2. Adobe Acrobat ([www.adobe.com](http://www.adobe.com)), Bluebeam PDF Revu ([www.bluebeam.com](http://www.bluebeam.com)), or other similar PDF review software for applying electronic stamps and comments.

- - - E N D - - -

**SECTION 01 35 26  
SAFETY REQUIREMENTS**

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**SECTION 01 35 26  
SAFETY REQUIREMENTS**

**1.1 APPLICABLE PUBLICATIONS:**

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Engineers (ASSE):

- A10.1-2011.....Pre-Project & Pre-Task Safety and Health Planning
- A10.34-2012.....Protection of the Public on or Adjacent to Construction Sites
- A10.38-2013.....Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations

C. American Society for Testing and Materials (ASTM):

- E84-2013.....Surface Burning Characteristics of Building Materials

D. The Facilities Guidelines Institute (FGI):

- FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities

E. National Fire Protection Association (NFPA):

- 10-2013.....Standard for Portable Fire Extinguishers
- 30-2012.....Flammable and Combustible Liquids Code
- 51B-2014.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
- 70-2014.....National Electrical Code
- 70B-2013.....Recommended Practice for Electrical Equipment Maintenance
- 70E-2012 .....Standard for Electrical Safety in the Workplace
- 99-2012.....Health Care Facilities Code
- 241-2013.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC Manual .....Comprehensive Accreditation and Certification  
Manual

G. U.S. Nuclear Regulatory Commission

10 CFR 20 .....Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904 .....Reporting and Recording Injuries & Illnesses

29 CFR 1910 .....Safety and Health Regulations for General  
Industry

29 CFR 1926 .....Safety and Health Regulations for Construction  
Industry

CPL 2-0.124.....Multi-Employer Citation Policy

I. VHA Directive 2005-007

**1.2 DEFINITIONS:**

- A. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- C. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- D. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- E. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
  - 1. Death, regardless of the time between the injury and death, or the length of the illness;
  - 2. Days away from work (any time lost after day of injury/illness onset);
  - 3. Restricted work;
  - 4. Transfer to another job;
  - 5. Medical treatment beyond first aid;

6. Loss of consciousness; or
7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

**1.3 REGULATORY REQUIREMENTS:**

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable [federal, state, and local] laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative.

**1.4 ACCIDENT PREVENTION PLAN (APP):**

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.
- B. The APP shall be prepared as follows:
  1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
  2. Address both the Prime Contractors and the subcontractors work operations.

3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
4. Address all the elements/sub-elements and in order as follows:
  - a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
    - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
    - 2) Plan approver (company/corporate officers authorized to obligate the company);
    - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
  - b. **BACKGROUND INFORMATION.** List the following:
    - 1) Contractor;
    - 2) Contract number;
    - 3) Project name;
    - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
  - c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
  - d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
    - 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
    - 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
    - 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;

- 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
  - 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
  - 6) Lines of authority;
  - 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;
- e. SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
- 1) Identification of subcontractors and suppliers (if known);
  - 2) Safety responsibilities of subcontractors and suppliers.
- f. TRAINING.**
- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
  - 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
  - 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
  - 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)
- g. SAFETY AND HEALTH INSPECTIONS.**
- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
  - 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)
- h. ACCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify

person(s) responsible to provide the following to the Contracting Officer Representative:

- 1) Exposure data (man-hours worked);
- 2) Accident investigations, reports, and logs.

**i. PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response ;
- 2) Contingency for severe weather;
- 3) Fire Prevention ;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);
- 8) Night operations and lighting ;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work ;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety
- 13) Hazardous energy control (Machine LOTO);
- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;
- 21) Radiation Safety Program;
- 22) Abrasive blasting;
- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) PreCast Concrete.

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to

the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

- D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34) and the environment.

#### **1.5 ACTIVITY HAZARD ANALYSES (AHAS):**

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.
- C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
  - 1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to

- the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
    - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
    - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
  3. Submit AHAs to the or Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
  4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
  5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the or Contracting Officer Representative.

#### **1.6 PRECONSTRUCTION CONFERENCE:**

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

**1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):**

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee.

**1.8 TRAINING:**

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and

Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Resident Engineer that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

#### **1.9 INSPECTIONS:**

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

**1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:**

- A. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.
- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to Contracting Officer Representative monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

**1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):**

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
  - 1. Hard Hats - unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement

of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.

2. Safety glasses - unless written authorization is given by the Contracting Officer Representative appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative.
4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

#### 1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Resident Engineer. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class III**, however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:

1. Class I requirements:

- a. During Construction Work:

- 1) Notify the Contracting Officer Representative

- 2) Execute work by methods to minimize raising dust from construction operations.
  - 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.
- b. Upon Completion:
- 1) Clean work area upon completion of task
  - 2) Notify the Contracting Officer Representative
2. Class II requirements:
- a. During Construction Work:
- 1) Notify the Contracting Officer Representative
  - 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
  - 3) Water mist work surfaces to control dust while cutting.
  - 4) Seal unused doors with duct tape.
  - 5) Block off and seal air vents.
  - 6) Remove or isolate HVAC system in areas where work is being performed.
- b. Upon Completion:
- 1) Wipe work surfaces with cleaner/disinfectant.
  - 2) Contain construction waste before transport in tightly covered containers.
  - 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
  - 4) Upon completion, restore HVAC system where work was performed
  - 5) Notify the Contracting Officer Representative
3. Class III requirements:
- a. During Construction Work:
- 1) Obtain permit from the Contracting Officer Representative
  - 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
  - 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
  - 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording

and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.

- 5) Contain construction waste before transport in tightly covered containers.
- 6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Vacuum work area with HEPA filtered vacuums.
- 4) Wet mop area with cleaner/disinfectant.
- 5) Upon completion, restore HVAC system where work was performed.
- 6) Return permit to the Contracting Officer Representative

4. Class IV requirements:

a. During Construction Work:

- 1) Obtain permit from the Contracting Officer Representative
- 2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
- 5) Seal holes, pipes, conduits, and punctures.
- 6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
- 7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Contain construction waste before transport in tightly covered containers.
- 4) Cover transport receptacles or carts. Tape covering unless solid lid.
- 5) Vacuum work area with HEPA filtered vacuums.
- 6) Wet mop area with cleaner/disinfectant.
- 7) Upon completion, restore HVAC system where work was performed.
- 8) Return permit to the Contracting Officer Representative

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
  - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the Resident Engineer and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
  - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
  - c. Class III & IV - Seal all penetrations in existing barrier airtight
  - d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
  - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
  - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

D. Products and Materials:

1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
2. Barrier Doors: Self Closing One-hour solid core wood in steel frame, painted
3. Dust proof one-hour drywall
4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
7. Disinfectant: Hospital-approved disinfectant or equivalent product
8. Portable Ceiling Access Module

E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

F. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Resident Engineer and Facility CSC for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.

- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
  2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
  3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
  5. The contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
  6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
  7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

J. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents, or building openings. HEPA filtration on intake vents is required where dust may be introduced.
2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

**1.13 TUBERCULOSIS SCREENING**

- A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
  2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
  3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent

statement to the fact on file with the employer before being allowed to return to work on VHA property.

#### **1.14 FIRE SAFETY**

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
  - 1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  - 2. Install one-hour temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
  - 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Resident Engineer.
- K. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.
- L. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Resident Engineer. Obtain permits from Resident Engineer at least 24 hours in advance.
- M. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.
- N. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- O. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

#### **1.15 ELECTRICAL**

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part

1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition ( refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate. Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.
  - 1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
  - 2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
  - 3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the The Contracting Officer Representative.
- D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly

suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

- E.** Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites shall have approved ground-fault circuit interrupters for personnel protection. "Assured Equipment Grounding Conductor Program" only is not allowed.

#### **1.16 FALL PROTECTION**

- A.** The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
  - 1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
  - 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
  - 3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
  - 4. Fall protection while using a ladder will be governed by the OSHA requirements.

#### **1.17 NOT USED**

#### **1.18 NOT USED**

#### **1.19 CRANES**

- A.** All crane work shall comply with 29 CFR 1926 Subpart CC.
- B.** Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no "Phase In" date of November 10, 2014.
- C.** A detailed lift permit shall be submitted 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis,

siting of crane and path of swing. The lift will not be allowed without approval of this document.

- D. Crane operators shall not carry loads
  - 1. over the general public or VAMC personnel
  - 2. over any occupied building unless
    - a. the top two floors are vacated
    - b. or overhead protection with a design live load of 300 psf is provided

#### **1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)**

- A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

#### **1.21 CONFINED SPACE ENTRY**

- A. All confined space entry shall comply with 29 CFR 1910.146 except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].
- B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Resident Engineer and/or Facility Safety.

#### **1.22 NOT USED**

#### **1.23 LADDERS**

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
  - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

#### **1.24 FLOOR & WALL OPENINGS**

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
  2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
  3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
  4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
  5. Workers are prohibited from standing/walking on skylights.

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">http://www.aabchq.com</a>
AAMA	American Architectural Manufacturer's Association <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>

AISC American Institute of Steel Construction  
<http://www.aisc.org>

AISI American Iron and Steel Institute  
<http://www.steel.org>

AITC American Institute of Timber Construction  
<http://www.aitc-glulam.org>

AMCA Air Movement and Control Association, Inc.  
<http://www.amca.org>

ANLA American Nursery & Landscape Association  
<http://www.anla.org>

ANSI American National Standards Institute, Inc.  
<http://www.ansi.org>

APA The Engineered Wood Association  
<http://www.apawood.org>

ARI Air-Conditioning and Refrigeration Institute  
<http://www.ari.org>

ASAE American Society of Agricultural Engineers  
<http://www.asae.org>

ASCE American Society of Civil Engineers  
<http://www.asce.org>

ASHRAE American Society of Heating, Refrigerating, and  
Air-Conditioning Engineers  
<http://www.ashrae.org>

ASME American Society of Mechanical Engineers  
<http://www.asme.org>

ASSE American Society of Sanitary Engineering  
<http://www.asse-plumbing.org>

ASTM American Society for Testing and Materials  
<http://www.astm.org>

AWI Architectural Woodwork Institute  
<http://www.awinet.org>

AWS American Welding Society  
<http://www.aws.org>

AWWA American Water Works Association  
<http://www.awwa.org>

BHMA Builders Hardware Manufacturers Association  
<http://www.buildershardware.com>

BIA Brick Institute of America  
<http://www.bia.org>

CAGI Compressed Air and Gas Institute  
<http://www.cagi.org>

CGA Compressed Gas Association, Inc.  
<http://www.cganet.com>

CI The Chlorine Institute, Inc.  
<http://www.chlorineinstitute.org>

CISCA Ceilings and Interior Systems Construction Association  
<http://www.cisca.org>

CISPI Cast Iron Soil Pipe Institute  
<http://www.cispi.org>

CLFMI Chain Link Fence Manufacturers Institute  
<http://www.chainlinkinfo.org>

CPMB Concrete Plant Manufacturers Bureau  
<http://www.cpm.org>

CRA California Redwood Association  
<http://www.calredwood.org>

CRSI Concrete Reinforcing Steel Institute  
<http://www.crsi.org>

CTI Cooling Technology Institute  
<http://www.cti.org>

DHI Door and Hardware Institute  
<http://www.dhi.org>

EGSA Electrical Generating Systems Association  
<http://www.egsa.org>

EEI Edison Electric Institute  
<http://www.eei.org>

EPA Environmental Protection Agency  
<http://www.epa.gov>

ETL ETL Testing Laboratories, Inc.  
<http://www.etl.com>

FAA Federal Aviation Administration  
<http://www.faa.gov>

FCC Federal Communications Commission  
<http://www.fcc.gov>

FPS The Forest Products Society  
<http://www.forestprod.org>

GANA Glass Association of North America  
<http://www.cssinfo.com/info/gana.html/>

FM Factory Mutual Insurance  
<http://www.fmglobal.com>

GA Gypsum Association  
<http://www.gypsum.org>

GSA General Services Administration  
<http://www.gsa.gov>

HI Hydraulic Institute  
<http://www.pumps.org>

HPVA Hardwood Plywood & Veneer Association  
<http://www.hpva.org>

ICBO International Conference of Building Officials  
<http://www.icbo.org>

ICEA Insulated Cable Engineers Association Inc.  
<http://www.icea.net>

\ICAC Institute of Clean Air Companies  
<http://www.icac.com>

IEEE Institute of Electrical and Electronics Engineers  
<http://www.ieee.org>

IMSA International Municipal Signal Association  
<http://www.imsasafety.org>

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association  
<http://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.  
<http://www.mss-hq.com>

NAAMM National Association of Architectural Metal Manufacturers  
<http://www.naamm.org>

NAPHCC Plumbing-Heating-Cooling Contractors Association  
<http://www.phccweb.org.org>

NBS National Bureau of Standards  
 See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors  
<http://www.nationboard.org>

NEC National Electric Code  
 See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association  
<http://www.nema.org>

NFPA National Fire Protection Association  
<http://www.nfpa.org>

NHLA National Hardwood Lumber Association  
<http://www.natlhardwood.org>

NIH National Institute of Health  
<http://www.nih.gov>

NIST National Institute of Standards and Technology  
<http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.  
<http://www.nelma.org>

NPA National Particleboard Association  
18928 Premiere Court  
Gaithersburg, MD 20879  
(301) 670-0604

NSF National Sanitation Foundation  
<http://www.nsf.org>

NWWDA Window and Door Manufacturers Association  
<http://www.nwwda.org>

OSHA Occupational Safety and Health Administration  
Department of Labor  
<http://www.osha.gov>

PCA Portland Cement Association  
<http://www.portcement.org>

PCI Precast Prestressed Concrete Institute  
<http://www.pci.org>

PPI The Plastic Pipe Institute  
<http://www.plasticpipe.org>

PEI Porcelain Enamel Institute, Inc.  
<http://www.porcelainenamel.com>

PTI Post-Tensioning Institute  
<http://www.post-tensioning.org>

RFCI The Resilient Floor Covering Institute  
<http://www.rfci.com>

RIS Redwood Inspection Service  
See - CRA

RMA Rubber Manufacturers Association, Inc.  
<http://www.rma.org>

SCMA Southern Cypress Manufacturers Association  
<http://www.cypressinfo.org>

SDI Steel Door Institute  
<http://www.steeldoor.org>

IGMA Insulating Glass Manufacturers Alliance  
<http://www.igmaonline.org>

SJI Steel Joist Institute  
<http://www.steeljoist.org>

SMACNA Sheet Metal and Air-Conditioning Contractors  
National Association, Inc.  
<http://www.smacna.org>

SSPC The Society for Protective Coatings  
<http://www.sspc.org>

STI Steel Tank Institute  
<http://www.steel tank.com>

SWI Steel Window Institute  
<http://www.steelwindows.com>

TCA Tile Council of America, Inc.  
<http://www.tileusa.com>

TEMA Tubular Exchange Manufacturers Association  
<http://www.tema.org>

TPI Truss Plate Institute, Inc.  
583 D'Onofrio Drive; Suite 200  
Madison, WI 53719  
(608) 833-5900

UBC The Uniform Building Code  
See ICBO

UL Underwriters' Laboratories Incorporated  
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada  
<http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau  
6980 SW Varns Road, P.O. Box 23145  
Portland, OR 97223  
(503) 639-0651

WRCLA Western Red Cedar Lumber Association  
P.O. Box 120786  
New Brighton, MN 55112  
(612) 633-4334

WWPA Western Wood Products Association  
<http://www.wwpa.org>

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

### 1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
  2. Packaging used for construction products.
  3. Poor planning and/or layout.
  4. Construction error.
  5. Over ordering.
  6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the Project Manager a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
  2. Techniques to be used to minimize waste generation.
  3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
  - a. On site: Material separation, storage, protection where applicable.
  - b. Off site: Transportation means and destination. Include list of materials.
    - 1) Description of materials to be site-separated and self-hauled to designated facilities.
    - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
  - c. The names and locations of mixed debris reuse and recycling facilities or sites.
  - d. The names and locations of trash disposal landfill facilities or sites.
  - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.
  1. Submit summary on Non-Hazardous Solid Waste Diversion Form to COTR prior to each payment request.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):  
LEED Green Building Rating System for New Construction

#### **1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

### **3.2 DISPOSAL**

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

### **3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal on Non-Hazardous Solid Waste Diversion form including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

**NON-HAZARDOUS SOLID WASTE DIVERSION**

<b>Contact information</b>	
Name	
Contractor Name	
Phone	
Date	
Dates Covered By The Following Figures	
Project Name(s) (e.g. Construction of Dental Clinic)	
<b>Construction and demolition related solid waste disposal data</b> (Do not include routine solid waste picked up by VA contractors)	
Total solid waste disposed (tons)	
Total cost for solid waste disposal	
<b>Construction and demolition related recycling data</b> (Do not include routine recycling such as aluminum cans and paper picked up by VA)	
Total recycled (tons)	
Total cost for recycling	
Total revenue for recycling	
Materials recycled (provide tons, cost, and revenue for each)	
Asphalt	
Concrete	
Wood scrap	
Metal	
Soil	
Other recycling (Do not include routine recycling such as aluminum cans and paper.) Describe and provide tons.	
Items reused that would otherwise be disposed. Please describe and provide tons.	
Pollution prevention accomplishments (Describe all efforts that reduced waste or saved resources)	
Green purchasing accomplishments (Describe energy efficient, environmentally friendly, bio-based, and recycled products used and/or purchased)	

- - - E N D - - -

## SECTION 02 41 01

### CUTTING AND PATCHING

#### PART 1 GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division Specification Sections, apply to this Section.

##### 1.02 SECTION INCLUDES

- A. Procedural requirements for cutting and patching.

##### 1.03 RELATED REQUIREMENTS

- A. Section 02 41 02 - Selective Demolition. Demolition of selected portions of the building.
- B. Section 09 91 00, Painting

##### 1.04 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

##### 1.05 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's

aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

#### **1.06 WARRANTY**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

### 3.03 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
  
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
  
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

- a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
  - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

**END OF SECTION**

**SECTION 02 41 02**  
**SELECTIVE DEMOLITION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Demolition and removal of selected portions of building or structure.

**1.02 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

**1.03 RELATED REQUIREMENTS**

- A. Section 02 41 01 - Cutting and Patching.

**1.04 SUBMITTALS**

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.

**1.05 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site.

**1.06 PROJECT CONDITIONS**

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

#### **1.06 WARRANTY**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

#### **PART 2 PRODUCTS (NOT USED)**

#### **PART 3 EXECUTION**

##### **3.01 EXAMINATION**

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

##### **3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide

temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

2. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

### **3.03 PREPARATION**

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

### **3.04 SELECTIVE DEMOLITION**

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations as required by Owner or Authority having Jurisdiction.
  4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  5. Dispose of demolished items and materials promptly.

- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition[ and cleaned] and reinstalled in their original locations after selective demolition operations are complete.

### **3.05 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### **3.06 CLEANING**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION**

**SECTION 22 05 11****COMMON WORK RESULTS FOR PLUMBING****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The requirements of this Section shall apply to all sections of Division 22.
- B. Definitions:
  - 1. Exposed: Piping and equipment exposed to view in finished rooms.

**1.2 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.
- C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements and will fit the space available.
- D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- F. Installing Contractor shall provide lists of previous installations for selected items of equipment. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.
- G. Manufacturer's Literature and Data: Manufacturer's literature shall be submitted under the pertinent section rather than under this section.
  - 1. Equipment and materials identification.
  - 2. Firestopping materials.
- H. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and

complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

I. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment. Include complete list indicating all components of the systems with diagrams of the internal wiring for each item of equipment.
2. Include listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided.

**1.3 QUALITY ASSURANCE**

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
3. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Contracting Officers Representative (COR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Asbestos products or equipment or materials containing asbestos shall not be used.
- B. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.
- C. Execution (Installation, Construction) Quality:
1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the COR for resolution. Printed copies or electronic files of manufacturer's installation instructions shall be provided to the COR at least 10 working days prior to commencing installation of any item.
  2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution.
  3. Installer Qualifications: Installer shall be licensed and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
  4. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or additional time to the Government.
- E. Guaranty: Warranty of Construction.
- F. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall". Reference to the "code official" or "owner" shall be interpreted to mean the COR.

G. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

**1.4 DELIVERY, STORAGE AND HANDLING**

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the COR. Such replacement shall be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

**1.5 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations.

Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them on Auto-Cad provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
- D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS FOR VARIOUS SERVICES**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372.
- B. In-line devices such as meters, building valves, check valves, stops, valves, and fittings shall comply with NSF 61 and NSF 372.
- C. End point devices must meet requirements of NSF 61 and NSF 372.

### **2.2 FACTORY-ASSEMBLED PRODUCTS**

- A. Standardization of components shall be maximized to reduce spare part requirements.
- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
  - 1. All components of an assembled unit need not be products of same manufacturer.
  - 2. Constituent parts that are alike shall be products of a single manufacturer.
  - 3. Components shall be compatible with each other and with the total assembly for intended service.
  - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to

deliver specified performance of the complete assembly at no additional cost or time to the Government.

- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, shall be the same make and model.

### **2.3 COMPATIBILITY OF RELATED EQUIPMENT**

- A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

### **2.4 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING**

- A. All material and equipment furnished and installation methods used shall conform to the requirements of Section 22 0512, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.
- B. Special Requirements:
  - 1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
  - 2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
  - 3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
    - a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
    - b. Other wiring at boilers and water heaters, and to control panels, shall be NFPA 70 designation THWN.
    - c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.

4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
  5. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1.
- C. Motor Efficiency and Power Factor: All motors, when specified as "high efficiency or Premium Efficiency" by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as "NEMA premium efficient". Motors not specified as "high efficiency or premium efficiency" shall comply with the requirements of the Energy Policy and Conservation Act.
- D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).
- E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.
- F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.
- G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

## **2.5 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with facility maintenance staff. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters.

- C. Control Items: All temperature, pressure, and controllers shall be labeled and the component's function identified. Identify and label each item as they appear on the control diagrams.
- D. Valve Tags and Lists:
1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
  2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
  3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. An additional copy of the valvelist shall be mounted in picture frames for mounting to a wall. COR shall instruct contractor where frames shall be mounted.
  4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling or access door.

## **2.6 GALVANIZED REPAIR COMPOUND**

- A. Mil. Spec. DOD-P-21035B, paint.

## **2.7 PIPE AND EQUIPMENT SUPPORTS**

- A. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
1. General Types (MSS SP-58):
    - a. Standard clevis hanger: Type 1; provide locknut.
    - b. Riser clamps: Type 8.
    - c. Wall brackets: Types 31, 32 or 33.
    - d. Saddle support: Type 36, 37 or 38.
    - e. Turnbuckle: Types 13 or 15.
    - f. U-bolt clamp: Type 24.

- g. Copper Tube:
  - 1) Hangers, clamps and other support material in contact with tubing shall be copper-coated.
  - 2) For vertical runs use copper-coated riser clamps.
  - 3) Insulated Lines: Provide pre-insulated shields sized for copper tube.
- 2. Plumbing Piping (Other Than General Types):
  - a. Horizontal piping: Type 1, 5, 7, 9, and 10.
  - b. Chrome plated piping: Chrome plated supports.
  - c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
  - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

## 2.8 PIPE PENETRATIONS

- A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
- B. Pipe penetration sleeve materials shall comply with all firestopping requirements for each penetration.
- C. To prevent accidental liquid spills from passing to a lower level, provide the following:
  - 1. For sleeves: Extend sleeve 50 mm (2 inch) above finished floor and provide sealant for watertight joint.
  - 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
  - 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- D. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.
- E. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- F. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.

- G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.
- H. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.
- I. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

## **2.9 TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.
- D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials shall be utilized when possible.

## **2.10 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

**2.11 ASBESTOS**

- A. Materials containing asbestos are not permitted.

**PART 3 - EXECUTION****3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.
- B. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.
- C. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.
- D. Location of pipe sleeves shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
1. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
  2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
- F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- G. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion

- of the COR, shall be replaced at no additional cost or time to the Government.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- H. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- I. Interconnection of Electrical Instrumentation and Controls: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.
- J. Many plumbing systems interface with the HVAC control system.
- K. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
  2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

### **3.2 TEMPORARY PIPING AND EQUIPMENT**

- A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury

can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 shall apply.

- C. Temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are not allowed in potable water systems. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

### **3.3 RIGGING**

- A. Openings in building structures shall be planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.
- C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.
- E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to COR for evaluation prior to actual work.

### **3.4 PIPE AND EQUIPMENT SUPPORTS**

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the COR.
- B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.
- C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work shall be provided.

- D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.
- E. Overhead Supports:
  - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
  - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
  - 3. Tubing and capillary systems shall be supported in channel troughs.

### **3.5 PLUMBING SYSTEMS DEMOLITION**

- A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.
- C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and

specifications of the other disciplines in the project for additional facilities to be demolished or handled.

- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate. Coordinate with the COR and Infection Control.

### **3.6 CLEANING AND PAINTING**

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned.
- B. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
  2. The following Material and Equipment shall NOT be painted:
    - a. Motors, controllers, control switches, and safety switches.
    - b. Control and interlock devices.
    - c. Regulators.
    - d. Pressure reducing valves.
    - e. Control valves and thermostatic elements.
    - f. Lubrication devices and grease fittings.
    - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
    - h. Valve stems and rotating shafts.
    - i. Pressure gages and thermometers.
    - j. Glass.
    - k. Name plates.
  3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint type and color obtained from manufacturer or computer matched.
  4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.

**3.7 IDENTIFICATION SIGNS**

- A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data shall be placed on factory built equipment.

**3.8 STARTUP AND TEMPORARY OPERATION**

- A. Startup of equipment shall be performed as described in the equipment specifications.

**3.9 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

**3.10 OPERATION AND MAINTENANCE MANUALS**

- A. All new and temporary equipment and all elements of each assembly shall be included.
- B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.
- C. Manufacturer's installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.
- D. Lubrication instructions, type and quantity of lubricant shall be included.
- E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.
- F. Set points of all interlock devices shall be listed.
- G. Trouble-shooting guide for the control system troubleshooting shall be inserted into the Operations and Maintenance Manual.

- H. The control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.
- I. Emergency procedures for shutdown and startup of equipment and systems.

- - - E N D - - -

**SECTION 22 05 12****GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section describes the general motor requirements for plumbing equipment and applies to all sections of Division 22.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT", with applicable paragraph identification.
- C. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Motor nameplate information shall be submitted including electrical ratings, dimensions, mounting details, materials, horsepower, power factor, current as a function of speed, current efficiency, speed as a function of load, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
  - 3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.
- D. Operating and Maintenance Manuals: Companion copies of complete maintenance and operating manuals, including technical data sheets and application data shall be submitted simultaneously with the shop drawings. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

- E. Certification: Two weeks prior to final inspection, unless otherwise noted, the following certification shall be submitted to the Contracting Officer's Representative (COR).
1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

## **PART 2 - PRODUCTS**

### **2.1 MOTORS**

- A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.
- B. For severe duty totally enclosed motors, IEEE 841 shall apply.
- C. Voltage ratings shall be as follows:
1. Single phase:
    - a. Motors connected to 120-volt systems: 115 volts.
    - b. Motors connected to 208-volt systems: 200 volts.
    - c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
  2. Three phase:
    - a. Motors connected to 208-volt systems: 200 volts.
    - b. Motors, less than 74.6 kW (100 HP), connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
    - c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
    - d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
    - e. Motors connected to high voltage systems: Shall conform to NEMA MG 1 Standards for connection to the nominal system voltage shown on the drawings.
- D. Number of phases shall be as follows:
1. Motors, less than 373 W (1/2 HP): Single phase.
  2. Motors, 373 W (1/2 HP) and larger: 3 phase.
  3. Exceptions:
    - a. Hermetically sealed motors.
    - b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
- E. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

F. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration and running torque without exceeding nameplate ratings or considering service factor.

G. Motor Enclosures:

1. Shall be the NEMA types shown on the drawings for the motors.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.
4. All motors in hazardous locations shall be approved for the application and meet the Class and Group as required by the area classification.

H. Electrical Design Requirements:

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (144 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable Voltage or Adjustable Frequency Controls, or both, or NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.

I. Mechanical Design Requirements:

1. Bearings shall be rated for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hour rating. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.

3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
  4. Grease fittings, if provided, shall be Alemite type or equivalent.
  5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
  6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
  7. Noise level shall meet the requirements of the application.
  8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
  9. All external fasteners shall be corrosion resistant.
  10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
  11. Winding thermostats, when specified shall be normally closed, connected in series.
  12. Grounding provisions shall be in the main terminal box.
- J. Additional requirements for specific motors, as indicated in other sections, shall also apply.
- K. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 W (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W (1 HP) or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%

- L. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be

installed unless the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.
- B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

- - - E N D - - -

**SECTION 22 05 19**

**METERS AND GAGES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the requirements for water meters and gages primarily used for troubleshooting the system and to indicate system performance.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 19, METERS AND GAGES FOR PLUMBING PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Pressure Gages.
  - 2. Thermometers.
  - 3. Product certificates.
  - 4. BACnet communication protocol.
- D. Operations and Maintenance manual shall include:
  - 1. System Description.
  - 2. Major assembly block diagrams.
  - 3. Troubleshooting and preventive maintenance guidelines.
  - 4. Spare parts information.
- E. Shop Drawings shall include the following: One line, wiring and terminal diagrams including terminals identified, protocol or communication modules, and Ethernet connections.

**1.5 AS-BUILT DOCUMENTATION**

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit copies of complete operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder per the requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND

SAMPLES. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. A list of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

## **PART 2 - PRODUCTS**

### **2.1 PRESSURE GAGES FOR WATER**

- A. ASME B40.100 all metal case 115 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to 1380 kPa (0 to 200 psig) gage.
- B. The pressure element assembly shall be bourdon tube. The mechanical movement shall be lined to pressure element and connected to pointer.
- C. The dial shall be non-reflective aluminum with permanently etched scale markings graduated in kPa and psig.
- D. The pointer shall be dark colored metal.
- E. The window shall be glass.
- F. The ring shall be brass or stainless steel.
- G. The accuracy shall be grade A, plus or minus 1 percent of middle half of scale range.
- H. The pressure gage for water domestic use shall conform to NSF 61.

### **2.2 THERMOMETERS**

- A. Thermometers shall be straight stem, metal case, red liquid-filled thermometer, approximately 175 mm (7 inches) high, 4 degrees C to 100 degrees C (40 degrees F to 212 degrees F). Thermometers shall comply with ASME B40.200.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Direct mounted pressure gages shall be installed in piping tees with pressure gage located on pipe at the most readable position.
- B. Valves and snubbers shall be installed in piping for each pressure gage.
- C. Test plugs shall be installed on the inlet and outlet pipes of all heat exchangers or water heaters serving more than one plumbing fixture.
- D. Pressure gages shall be installed where indicated on the drawings.

- E. Thermometers shall be installed on the water heater inlet and outlet piping, thermostatic mixing valve outlet piping, and the hot water circulation pump inlet piping.
- F. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

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**SECTION 22 05 23****GENERAL-DUTY VALVES FOR PLUMBING PIPING****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section describes the requirements for general-duty valves for domestic water and sewer systems.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 23, VALVES FOR PLUMBING PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Ball Valves.
  - 2. Butterfly Valves.
  - 3. Balancing Valves.
  - 4. Check Valves.
  - 5. Water Pressure Reducing Valves and Connections.
  - 6. Thermostatic Mixing Valves.
- D. Test and Balance reports for balancing valves.
- E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
  - 4. Piping diagrams of thermostatic mixing valves to be installed.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Valves shall be prepared for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.

4. Set butterfly valves closed or slightly open.
  5. Block check valves in either closed or open position.
- B. Valves shall be prepared for storage as follows:
1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature.

## **PART 2 - PRODUCTS**

### **2.1 VALVES, GENERAL**

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
- C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.
- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.
- E. All valves used to supply potable water shall meet the requirements of NSF 61 and NSF 372.

### **2.2 SHUT-OFF VALVES**

- A. Cold, Hot and Re-circulating Hot Water:
  1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be non-lead solder.
  2. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A536, ductile iron.

### **2.3 BALANCING VALVES**

- A. Hot Water Re-circulating manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have

differential pressure read-out ports across the valve seat area and integral thermometer. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (1/4 inch NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.

#### **2.4 CHECK VALVES**

- A. Class 125, bronze swing check valves with non-metallic disc suitable for type of service. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.

#### **2.5 WATER PRESSURE REDUCING VALVE AND CONNECTIONS**

- A. The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The pressure reducing valve shall meet ASSE 1003. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.
- B. The pressure reducing valve shall consist of a flanged cast iron body and rated to 1380 kPa (200 psig). The valve shall have a large elastomer diaphragm for sensitive response. The pressure reducing valve shall meet ASSE 1003.
- C. The regulator shall have a tap for pressure gauge.
- D. The regulator shall have a temperature rating of 100 degrees C (212 degrees F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9 kPa (+/- 1 psig).
- E. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

#### **2.6 THERMOSTATIC MIXING VALVES**

- A. Thermostatic Mixing Valves shall comply with the following general performance requirements:
  - 1. Shall meet ASSE requirements for water temperature control.

2. The body shall be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
  3. No special tool shall be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
  4. Valve shall be able to be placed in various positions without making temperature adjustment or reading difficult.
  5. Valve finish shall be chrome plated in exposed areas.
  6. Valve shall allow easy temperature adjustments to allow hot water circulation. Internal parts shall be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.
  7. Parts shall be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
  8. Valve shall have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature shall be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.
  9. Provide mixing valves with integral check valves with screens and stop valves.
- B. MV-1 - Digital Re-Circulating Valve (DRV)
1. Re-circulating valve shall be digital of lead-free stainless steel/polymer construction.
  2. DRV shall have 3 inch inlet/outlet connections, deliver a mixed water flow of 165 gpm at 7.5 ft./sec. and shall have no minimum system draw off requirement.
  3. DRV shall be supplied pre-piped and pressure tested with a lead free re-circulation return manifold with check valves.
  4. DRV shall have all of the following operational capabilities:
    - a. +/- 2 deg F water temperature control.
    - b. 2 deg F minimum inlet to outlet water temperature differential.
    - c. Automatic shutoff of hot water flow upon cold water inlet supply failure.
    - d. Automatic shutoff of hot water flow in the event of a power failure.
    - e. Programmable setpoint range of 81 - 159 deg F.
    - f. Programmable thermal disinfection mode.
    - g. Programmable 1<sup>st</sup> Level hi/lo temp alarm display.
    - h. Programmable temperature error level for safety shutdown.

5. DRV shall have all of the following connectivity capabilities:
  1. SPCO relay outputs which are energized during operation.
  2. LCD display which indicates: Setpoint, delivered temperature, error codes, and alarm conditions.
  3. MODBUS 485 port for remote setpoint adjustment and remote operating temperature visibility
  4. RS485 Serial Port for connection to a performance matched hot water monitoring system.
6. DRV shall be compliant with ASSE Standard 1017 and CSA B125 and so certified and identified.
7. DRV shall be UL listed and identified.

C. MV-2:

1. The thermostatic mixing valve (TMV) shall be chrome-plated DZR brass/polymer construction. TMV shall have NPT inlets and outlet with integral inlet spring loaded check valves and strainers, and an optional top or bottom mixed water outlet. TMV shall be equipped with a maximum temperature limiting and single temperature locking feature. TMV shall have dual thermostats for increased accuracy and to provide redundancy in case of individual thermostat failure.
2. Materials of construction and items included shall be:
  - a. Chrome-plated DZR brass/polymer.
  - b. 1 inch NPT inlets and outlet.
  - c. Optional top or bottom mixed water outlet.
  - d. Integral inlet check valves and strainers.
  - e. Dual thermostats.
3. Performance: TMV shall be so designed that all of the internal operating components are enclosed in a one-piece, "sealed for life" replaceable cartridge for each of service. TMV shall be capable of controlling mixed water temperatures +/- 2 deg F at flow rates between 1 and 24 fpm. TMV shall be capable of delivering a mixed water temperature that is within 5 deg F of either inlet supply temperature. TMV shall be compliance with ASSE Standard 1017 and CSA B125 and shall be so certified and identified.
4. The thermostatic mixing valve shall include all of the following capabilities:
  - a. Maintains mixed water temperatures +/- 2 deg at flow rates between 1 and 24 gpm.
  - b. Delivers mixed water temperature within 5 deg F of either inlet supply temperature.
  - c. Operational pressure of 10-150 psig.

d. Thermal shutdown mode upon inlet supply failure.

D. MV-3:

1. The thermostatic mixing valve (TMV) shall be chrome-plated DZR brass/polymer construction. TMV shall be supplied as standard pre-plumbed and pressure-tested, enclosed in a 26 inch by 30 inch by 10 inch stainless steel recessed cabinet with a 2 inch flange. Cabinet shall have a polished stainless steel piano-hinged door with keyed cylinder lock. TMV shall have optional top or bottom NPT inlets and outlet with integral combination inlet check stop/union/strainers, and outlet stop valve and thermometer. TMV shall be equipped with a maximum temperature limiting and single temperature locking feature. TMV shall have dual thermostats for increased accuracy and to provide redundancy in case of individual thermostat failure.
2. Materials of construction and items included shall be:
  - a. Chrome-plated DZR brass/polymer.
  - b. Cabinet Options:
    1. Premium: 14 gauge #4 finish stainless steel.
    2. Standard: 18 gauge #4 finish stainless steel.
    3. Baked Enamel: 18 gauge white enameled steel.
  - c. Integral combination inlet check stop/union/strainers.
  - d. Outlet stop valve and thermometer.
  - e. Dual thermostats.
3. Performance: TMV shall be capable of controlling mixed water temperatures +/- 2 deg F at flow rates between 2 and 48 gpm. TMV shall be capable of delivering a mixed water temperature that is within 5 deg F of either inlet supply temperature. TMV shall be compliant with ASSE Standard 1017 and CSA B125 and shall be so certified and identified.
4. The thermostatic mixing valve shall include all of the following capabilities:
  - a. Maintains mixed water temperatures +/- 2 deg F at flow rates between 2 and 48 gpm.
  - b. Delivers mixed water temperature within 5 deg F of either inlet supply temperature.
  - c. Operational pressure of 10-150 psig.
  - d. Thermal shutdown mode upon inlet supply failure.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.
- D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

**3.2 INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves shall be installed in horizontal piping with stem at or above center of pipe.
- D. Valves shall be installed in a position to allow full stem movement.
- E. Check valves shall be installed for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.
  - 1. Install thermometers.
- G. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

**3.3 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Calibrated balancing valves.
  - 2. Thermostatic, water mixing valves.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

**3.4 ADJUSTING**

- A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves shall be replaced if persistent leaking occurs.
- B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.
- D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA Contracting Officer's Representative (COR).

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**SECTION 22 05 93**  
**TESTING, ADJUSTING, AND BALANCING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Testing, adjusting, and balancing (TAB) of plumbing systems. TAB includes the following:
1. Planning systematic TAB procedures.
  2. Design Review Report.
  3. Systems Inspection report.
  4. Systems Readiness Report.
  5. Balancing plumbing water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
  6. Recording and reporting results.
- B. Definitions:
1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of 2007 ASHRAE Handbook, "HVAC Applications".
  2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
  3. AABC: Associated Air Balance Council.
  4. NEBB: National Environmental Balancing Bureau.
  5. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

**1.2 QUALITY ASSURANCE**

- A. Qualifications:
1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
  2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Resident Engineer and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB

agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

- 3. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.

D. Tab Criteria:

- 1. One or more of the applicable AABC, NEBB or SMACNA publications.

**1.3 SUBMITTALS**

A. Submit Following for Review and Approval:

- 1. Systems inspection report on equipment and installation for conformance with design.
- 2. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests.
- 3. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

B. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

**1.4 APPLICABLE PUBLICATIONS**

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

- 2007 .....HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control

C. Associated Air Balance Council (AABC):

- 2002.....AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):

- 7<sup>th</sup> Edition 2005 .....Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

2nd Edition 2006 .....Procedural Standards for the Measurement of  
Sound and Vibration

3<sup>rd</sup> Edition 2009 .....Procedural Standards for Whole Building Systems  
Commissioning of New Construction

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Obtain applicable contract documents and copies of approved submittals for automatic control systems.

**3.2 DESIGN REVIEW REPORT**

- A. The TAB Specialist shall review the Contract Plans and specifications and advise the Resident Engineer of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

**3.3 SYSTEMS INSPECTION REPORT**

- A. Inspect equipment and installation for conformance with design.
- B. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments.

**3.4 TAB PROCEDURES**

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation.
- C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre construction water flow rate and for each phase of the project prior to partial final inspections of each phase of the project.
- D. Water Balance and Equipment Test: Include circulating pumps, and balancing devices.

**3.5 PHASING**

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the

project all areas shall have been tested and balanced per the contract documents.

- B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

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**SECTION 22 07 11  
PLUMBING INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Field applied insulation for thermal efficiency and condensation control for
1. Plumbing piping and equipment.
  2. Re-insulation of plumbing piping and equipment after asbestos abatement.
- B. Definitions
1. ASJ: All service jacket, white finish facing or jacket.
  2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  3. Cold: Equipment or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
  4. Concealed: Piping above ceilings and in chases, interstitial space, and pipe spaces.
  5. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
  6. FSK: Foil-scrim-kraft facing.
  7. Hot: Plumbing equipment or piping handling media above 41 degrees C (105 degrees F).
  8. Density:  $\text{kg/m}^3$  - kilograms per cubic meter (Pcf - pounds per cubic foot).
  9. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watts per square meter (BTU per hour per square foot).
    - b. Pipe or Cylinder: Watts per square meter (BTU per hour per linear foot).
  10. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
  11. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of

this specification, vapor retarders shall have a maximum published

permeance of 0.1 perms and vapor barriers shall have a maximum

published permeance of 0.001 perms.

12. R: Pump recirculation.

13. CW: Cold water.

14. SW: Soft water.

15. HW: Hot water.

16. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

## 1.2 RELATED WORK

A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.

B. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING and Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

## 1.3 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

**4.3.3.1** Pipe insulation and coverings, vapor retarder facings, adhesives, fasteners, tapes, unless otherwise provided for in 4.3.3.1.12 or 4.3.3.1.2, shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

**4.3.3.1.1** Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

**4.3.3.3** Pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

**4.3.3.3.1** In no case shall the test temperature be below 121°C (250°F).

**4.3.10.2.6.3** Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL

1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.10.2.6.7 Smoke detectors shall not be required to meet the provisions of this section.

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings:
  1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.
    - b. Insulation facings and jackets: Each type used.
    - c. Insulation accessory materials: Each type used.
    - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
    - e. Make reference to applicable specification paragraph numbers for coordination.

#### **1.5 STORAGE AND HANDLING OF MATERIAL**

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

**PART 2 - PRODUCTS****2.1 MINERAL FIBER OR FIBER GLASS**

- A. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1,  $k = 0.037$  (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering. ■

**2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

ASTM C177, C518,  $k = 0.039$  (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

**2.3 INSULATION FACINGS AND JACKETS**

- A. Vapor Retarder, higher strength with low water permeance  $\leq 0.02$  or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.
- D. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

**2.4 PIPE COVERING PROTECTION SADDLES**

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of  $48 \text{ kg/m}^3$  (3.0 pcf).

<b>Nominal Pipe Size and Accessories Material (Insert Blocks)</b>	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

## **2.5 FLAME AND SMOKE**

- A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

## **PART 3 - EXECUTION**

### **3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

- D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.
- E. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- F. Plumbing work not to be insulated:
  - 1. Piping and valves of fire protection system.
  - 2. Chromium plated brass piping.
  - 3. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
- G. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

### **3.2 INSULATION INSTALLATION**

- A. Molded Mineral Fiber Pipe and Tubing Covering:
  - 1. Fit insulation to pipe, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
  - 2. Contractor's options for fitting, flange and valve insulation:
    - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
    - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
    - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

- d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
- B. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
  2. Pipe and tubing insulation:
    - a. Use proper size material. Do not stretch or strain insulation.
    - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
    - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
  3. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.-

### 3.3 PIPE INSULATION SCHEDULE

Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and	Flexible Elastomeric Cellular Thermal (Above	38 (1.5)	38 (1.5)	----	----

Return)	ground piping only)				
(4-16 degrees C (40-60 degrees F)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

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**SECTION 22 11 00  
FACILITY WATER DISTRIBUTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

**1.2 RELATED WORK**

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

- A. Manufacturer's Literature and Data:
  - 1. All items listed in Part 2 - Products.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute (ANSI):
  - B16.15-2006 .....Cast Copper Alloy Threaded Fittings Classes 125 and 250
  - B16.18-2001 (R2005).....Cast Copper Alloy Solder-Joint Pressure Fittings
  - B16.22-2012.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
  - B16.51-2011.....Copper and Copper Alloy Press-Connect Fittings
  - NSF/ANSI 61-2012.....Drinking Water System Components - Health Effects
- C. American Society for Testing and Materials (ASTM):
  - B32-08.....Solder Metal
  - B75/B75M-11.....Seamless Copper Tube
  - B88-09.....Seamless Copper Water Tube
- D. International Code Council (ICC)
  - ICC IPC (2012).....International Plumbing Code
- E. NSF International (NSF)
  - NSF/ANSI 61 (2012).....Drinking Water System Components - Health Effects
  - NSF/ANSI 372 (2011).....Drinking Water System Components - Lead Content

**1.5 QUALITY ASSURANCE**

- A. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

- B. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

**1.6 SPARE PARTS**

- A. For mechanical press-connect fittings, provide tools required for each pipe size used at the facility.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372. Endpoint devices used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.

**2.2 ABOVE GROUND (INTERIOR) WATER PIPING**

- A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 6 inches (150 mm) and larger, stainless steel, ASTM A312, schedule 10 shall be used.
- B. Fittings for Copper Tube:
  - 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
  - 2. Grooved fittings, 2 to 6 inch (50 to 150 mm) wrought copper ASTM B75 C12200, 5 to 6 inch (125 to 150 mm) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
  - 3. Mechanical press-connect fittings for copper pipe and tube shall conform to the material and sizing requirements of ASME B16.51, 2 inch (50 mm) size and smaller mechanical press-connect fittings, double pressed type, with EPDM (ethylene propylene diene monomer) non-toxic synthetic rubber sealing elements and un-pressed fitting identification feature.
  - 4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
- C. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.
- D. Brazing alloy: AWS A5.8, Classification BCuP.

### **2.3 EXPOSED WATER PIPING**

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
1. Pipe: Fed. Spec. WW-P-351, standard weight.
  2. Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish.
  3. Nipples: ASTM B 687, Chromium-plated.
  4. Unions: Mss SP-72, SP-110, Brass or Bronze with chrome finish. Unions 2-1/2 inches (65 mm) and larger shall be flange type with approved gaskets.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required.

### **2.4 STRAINERS**

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage. Strainer element shall be removable without disconnection of piping.
- B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- C. Body: Smaller than 3 inches (80 mm), brass or bronze; 3 inches (80 mm) and larger, cast iron or semi-steel.

### **2.5 DIELECTRIC FITTINGS**

- A. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

### **2.6 STERILIZATION CHEMICALS**

- A. Hypochlorite: ASTM E1120-08
- B. Liquid Chlorine: ASTM E1229-08

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General: Comply with the International Plumbing Code and the following:
1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
  2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

3. All pipe runs shall be laid out to avoid interference with other work.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
  - a. All piping shall be supported per the International Plumbing Code.
  - b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with red lead or zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
  - c. Floor, Wall and Ceiling Plates, Supports, Hangers:
    - 1) Solid or split un-plated cast iron.
    - 2) All plates shall be provided with set screws.
    - 3) Pipe Hangers: Height adjustable clevis type.
    - 4) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (min.) metal protection shield Centered on and welded to the hanger and support. The shield shall be 4 inches in length and be 16 gauge steel. The shield shall be sized for the insulation.
    - 5) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
  - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
- 8 Mechanical press-connect fitting connections shall be made in accordance with the manufacturer's installation instructions. Depth of insertion must be marked on the tube prior to inserting the tube into the fitting. Ensure the tube is completely inserted to the fitting stop (appropriate depth) and squared with the fitting prior to applying the pressing jaws onto the fitting. The joints shall be

pressed using the tool(s) approved by the manufacturer. Minimum distance between fittings shall be in accordance with the manufacturer's requirements. When the pressing cycle is complete, visually inspect the joint to ensure the tube has remained fully inserted, as evidenced by the visible insertion mark.

B. Piping shall conform to the following:

1. Domestic Water:

- a. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
- b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

**3.2 TESTS**

- A. General: Test system either in its entirety or in sections. Submit testing plan to Resident Engineer/COR 14 days prior to test date.
- B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 150 psi (1040 kPa) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
- C. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

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**SECTION 22 11 23  
DOMESTIC WATER PUMPS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Hot water circulating pump.

**1.2 RELATED WORK**

- A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Pump:
    - a. Manufacturer and model.
    - b. Operating speed.
    - c. Capacity.
    - d. Characteristic performance curves.
  - 2. Motor:
    - a. Manufacturer, frame and type.
    - b. Speed.
    - c. Current Characteristics.
    - d. Efficiency.
- C. Certified copies of all the factory and construction site test data sheets and reports.
- D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
  - ICS6-93 (R2006).....Industrial Control and Systems Enclosures
  - 250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)

- C. American Society of Mechanical Engineers (ASME):  
Boiler and Pressure Vessel Code: 2010  
Section VIII.....Pressure Vessels, Division I and II
- D. International Code Council (ICC)  
ICC IPC (2012).....International Plumbing Code
- E. NSF International (NSF)  
NSF/ANSI 61 (2012).....Drinking Water System Components - Health  
Effects  
NSF/ANSI 372 (2011).....Drinking Water System Components - Lead Content
- F. Underwriters' Laboratories, Inc. (UL):  
508-99 (R2008)..... Standards for Industrial Control Equipment

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372.

### **2.2 CIRCULATING PUMP**

- A. Centrifugal, single stage, constructed to prevent contact of water with metal other than nonferrous. Driver shall be electric motor, close coupled or connected by flexible or magnetic coupling. Pump for hot water system shall be designed for 65 degrees C (150 degrees F) water service.
- B. Mounting shall be either of the following:
  - 1. In-line mounted.
- C. Casings: Epoxy coated cast iron, bronze, stainless steel.
- D. Shaft and Impeller: 304 stainless steel impeller, 431 stainless steel shaft, accurately machined and properly balanced.
- E. Motors: Maximum 40 degrees C (104 degrees F) ambient temperature rise, drip proof, for operation with current, voltage, phase and cycle shown in schedule on Electrical drawings, conforming to NEMA 250-Type 4. Size the motor capacity to operate the pump without overloading. In-line pump motors shall not exceed 1800 rpm and shall be provided with spring mountings or equal devices to assure quiet operation. Motors shall be equipped with thermal overload protection. When motor has cooled down it shall re-start automatically if the operating control has been left on and the system requires pump to start.
- F. A check valve shall be installed in the pump discharge piping immediately downstream of the pump

**PART 3 - EXECUTION****3.1 STARTUP AND TESTING**

- A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.
- C. When any defects are detected, correct defects and repeat test.

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- NSF/ANSI 14 (2013).....Plastics Piping System Components and Related  
Materials
- NSF/ANSI 61 (2012).....Drinking Water System Components - Health  
Effects
- NSF/ANSI 372 (2011).....Drinking Water System Components - Lead Content
- H. American with Disabilities Act (A.D.A) Section 4-19.4 Exposed Pipes and  
Surfaces
- I. Environmental Protection Agency EPA PL 93-523 1974; A 1999) Safe  
Drinking Water Act.
- J. International Building Code, ICC IPC 2012.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372. Endpoint devices used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9.

### **2.2 STOPS**

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to Resident Engineer.
- C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.
- D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.

### **2.3 BATHTUBS**

- A. Bathtub (Thermostatic Valve):
1. Valve: Type T/P combination thermostatic and pressure balancing, wall mounted shower with chrome plated metal lever type operating handle with adjustment for rough-in variation and chrome plated brass or CRS face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS, or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops and temperature limit stops. Set stops for a maximum temperature of 40 degrees C (105 degrees F). All

exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 160 mL/m (2.5 gpm) at 310 kPa (45 psi) pressure drop.

#### 2.4 LAVATORIES AND SINKS

- A. Stops: Angle type, see paragraph 2.2 Stops. Provide cover per A.D.A 4-19.4.
- B. Thermostatic Mixing Valve: Combination thermostatic and pressure balanced mixing valve complete with check valve at both inlets.
  - 1. Temperature adjustment 85-120 deg F.
  - 2. Control: +/- 3 deg F.
  - 3. Minimum Flow Rate: .5 gpm.
  - 4. Minimum Temperature Differential Hot Water Inlet and Mixed Water: 18 deg F.
  - 5. Minimum Temperature Differential Mixed Water to Cold Water Inlet: 9 deg F.
  - 6. Lead Content: 0.25%

#### 2.5 SINKS

- A. Faucet: Solid brass construction, combination faucet with replaceable monel seat, removable replacement unit containing all parts subject to wear, integral stops, mounted on wall above sink. Spout shall have a pail hook, 19 mm (3/4 inch) hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets shall be cast, formed, or drop forged copper alloy. Escutcheons shall be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, shall have a smooth bright finish. Provide 914 mm (36 inches) hose with wall hook. Centerline of rough in
- B. Valve:
  - 1. Type T/P combination thermostatic and pressure balancing with chrome plated metal lever type operating handle and chrome plated metal or CRS face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be IPS. Provide external screwdriver check stops, and temperature limit stops. Set stops for a maximum temperature of 43 degrees C (110 degrees F). All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 380 ml/s at 310 kPa (6 gpm at 45 psi) pressure drop.

#### 2.6 SHOWER BATH FIXTURE

- A. Shower Bath Fixture (Type T/P Combination Valve):
  - 1. Valves: Type T/P combination thermostatic and pressure balancing, with chrome plated metal lever type operating handle adjustable for rough-in variations and chrome plated metal or CRS face plate. Valve

body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops, vacuum breaker and temperature limit stops. Set stops for a maximum temperature of 40 degrees C (105 degrees F). All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 160 ml/s at 310 kPa (2.5 gpm at 45 psi) pressure drop.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Install T/P mixing valves and set temperature.

**3.2 CLEANING**

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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**SECTION 23 09 23**  
**DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Expand existing VAMCO Energy Management System (EMS) to incorporate the controls and sequences detailed on the Drawings. Include all engineering, programming, controls, updated graphics, and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty.
1. Grand Island: The existing EMS is a Metasys system provided and serviced by Johnson Controls, Inc. (JCI).
  2. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and items required for complete and fully functional Controls Systems.
  3. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.
- B. The contractor administered by this Section of the technical specifications shall observe the capabilities, communication network, services, spare capacity of the existing control system and its ECC prior to beginning work.
1. Upgrade the existing direct-digital control system's ECC to include all properties and services required by an ASHRAE Standard 135 BACnet B-AWS Profile. The upgraded ECC shall continue to communicate with the existing direct-digital control system's devices. The upgraded ECC shall communicate directly with the new native-BACnet devices over the existing control system's communications network without the use of a gateway. Provide programming converting the existing non-

BACnet devices, objects and services to ASHRAE Standard 135 BACnet-complaint BIBBs. The contractor administered by this Section of the technical specifications shall provide all necessary investigation and site-specific programming to execute the interoperability schedules.

2. The contractor administered by this Section of the technical specifications shall provide a peer-to-peer networked, stand-alone, distributed control system. This contractor is responsible for all device mounting and wiring.

## **1.2 QUALITY ASSURANCE**

### **A. Criteria:**

1. Single Source Responsibility of subcontractor: The Contractor shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

### **B. Codes and Standards:**

1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

## **1.3 PERFORMANCE**

### **A. The system shall conform to the following:**

1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per

graphic. All current data shall be displayed within ten (10) seconds of the request.

2. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

#### **1.4 WARRANTY**

- A. Labor and materials for control systems shall be warranted for a period as specified under Warranty.
- B. The on-line support service shall allow the Controls supplier to connect via (through password-limited access) VPN through the internet monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.
- C. Controls and Instrumentation subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

#### **1.5 SUBMITTALS**

- A. Manufacturer's literature and data for all components including the following:
  1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
  2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
  3. Catalog cut sheets of all equipment used. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.

4. Sequence of operations and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
  5. Color prints of proposed graphics with a list of points for display.
  6. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
  7. Schematic wiring diagrams for all control, communication and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
  8. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
  9. Riser diagrams of wiring between central control unit and all control panels.
  10. Scaled plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
  11. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
  12. Quantities of submitted items may be reviewed but are the responsibility of the contractor administered by this Section of the technical specifications.
- B. Product Certificates: Compliance with Article, QUALITY ASSURANCE.
- C. Licenses: Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.
- D. As Built Control Drawings:
1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
  2. Furnish one (1) stick set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
  3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.
- E. Operation and Maintenance (O/M) Manuals):
1. Include the following documentation:

- a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
  - b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
  - c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
  - d. Complete troubleshooting procedures and guidelines for all systems.
  - e. Complete operating instructions for all systems.
  - f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
  - g. Licenses, guaranty, and other pertaining documents for all equipment and systems.
- F. Submit Performance Report to Resident Engineer prior to final inspection.

#### **1.6 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)**

- A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35°C (65 to 90°F) at a relative humidity of 20 to 80% non-condensing.
- B. The CUs used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at -40 to 65°C (-40 to 150°F).
- C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.
- D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

#### **1.7 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):  
Standard 135-10.....BACNET Building Automation and Control Networks
- C. American Society of Mechanical Engineers (ASME):

- B16.18-01.....Cast Copper Alloy Solder Joint Pressure Fittings.
- B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. American Society of Testing Materials (ASTM):
- B32-08.....Standard Specification for Solder Metal
- B88-09.....Standard Specifications for Seamless Copper Water Tube
- B88M-09.....Standard Specification for Seamless Copper Water Tube (Metric)
- B280-08.....Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service
- D2737-03.....Standard Specification for Polyethylene (PE) Plastic Tubing
- E. Federal Communication Commission (FCC):
- Rules and Regulations Title 47 Chapter 1-2001 Part 15: Radio Frequency Devices.
- F. Institute of Electrical and Electronic Engineers (IEEE):
- 802.3-11.....Information Technology-Telecommunications and Information Exchange between Systems-Local and Metropolitan Area Networks- Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access method and Physical Layer Specifications
- G. National Fire Protection Association (NFPA):
- 70-11.....National Electric Code
- 90A-09.....Standard for Installation of Air-Conditioning and Ventilation Systems
- H. Underwriter Laboratories Inc (UL):
- 94-10.....Tests for Flammability of Plastic Materials for Parts and Devices and Appliances
- 294-10.....Access Control System Units
- 486A/486B-10.....Wire Connectors
- 555S-11.....Standard for Smoke Dampers
- 916-10.....Energy Management Equipment
- 1076-10.....Proprietary Burglar Alarm Units and Systems

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Use new products that the manufacturer is currently manufacturing. Spare parts shall be available for at least five years after completion of this contract.

### **2.2 CONTROLS SYSTEM ARCHITECTURE**

#### **A. General**

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.

2. The ECC, building controllers and principal communications network equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels - not "Clones" assembled by a third-party subcontractor.
  3. The networks shall, at minimum, comprise, as necessary, the following:
    - a. BACnet-compliant routers, bridges, switches, hubs, modems, gateways, interfaces and similar communication equipment.
    - b. Active processing BACnet-compliant building controllers connected to other BACnet-compliant controllers together with their power supplies and associated equipment.
    - c. Addressable elements, sensors, transducers and end devices.
    - d. Third-party equipment interfaces and gateways as described and required by the Contract Documents.
    - e. Other components required for a complete and working Control Systems as specified.
- B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards and to meet all requirements of the Contract Documents.
- C. Network Architecture
1. The Controls communication network shall utilize BACnet communications protocol operating over a standard Ethernet LAN and operate at a minimum speed of 100 Mb/sec.
  2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances and regulations. They may also utilize digital wireless technologies as appropriate to the application and if approved by the VA.
  3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the VA.
- D. Third Party Interfaces:
1. The contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls systems and building systems supplied by other trades.
  2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and start-up at their cost and shall cooperate fully with the contractor administered by this Section of the technical

specifications in a timely manner and at their cost to ensure complete functional integration.

### **2.3 COMMUNICATION**

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135-2008, BACnet.
  - 1. The Data link / physical layer protocol (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.
- B. Each controller shall have a communication port for connection to an operator interface.
- C. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

### **2.4 ENGINEERING CONTROL CENTER (ECC)**

- A. The ECC shall reside on a high-speed network. The ECC and each standard browser connected to server shall be able to access all system information.
- B. ECC and controllers shall communicate using BACnet protocol. ECC and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135-2008, BACnet Annex J.
- C. ECC Software:
  - 1. Provide for automatic system database save and restore on the ECC's hard disk a copy of the current database of each Controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the ECC shall automatically restore the database for that panel. This capability may be disabled by the operator.
  - 2. System Graphics. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
  - 3. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics,

- icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the ECC. The operating system shall be Windows XP or better, and shall support the third party software.
4. Provide graphical user software, which shall minimize the use of keyboard through the use of the mouse and "point and click" approach to menu selection.
  5. User access shall be protected by a flexible and Owner re-definable software-based password access protection. Password protection shall be multi-level and partition able to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
  6. The system shall be completely field-programmable from the common operator's keyboard thus allowing hard disk storage of all data automatically. All programs for the CUs shall be able to be downloaded from the hard disk.
  7. Provide functionality such that using the least amount of steps to initiate the desired event may perform any of the following simultaneously:
    - a. Dynamic color graphics and graphic control.
    - b. Alarm management.
    - c. Event scheduling.
    - d. Dynamic trend definition and presentation.
    - e. Program and database editing.
    - f. Each operator shall be required to log on to the system with a user name and password to view, edit or delete the data. System security shall be selectable for each operator, and the password shall be able to restrict the operator's access for viewing and changing the system programs. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a selected time.
  8. Graphic Displays:
    - a. The workstation shall allow the operator to access various system schematics and floor plans via a graphical penetration scheme, menu selection, or text based commands. Graphic software shall

permit the importing of AutoCAD or scanned pictures in the industry standard format (such as PCX, BMP, GIF, and JPEG) for use in the system.

- b. System Graphics shall be project specific and schematically correct for each system. Standard system graphics that do not match equipment or system configurations are not acceptable. Operator shall have capability to manually operate the entire system from each graphic screen at the ECC. Each system graphic shall include a button/tab to a display of the applicable sequence of operation.
  - c. Dynamic values and status indication shall be shown in their locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh values.
  - d. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
  - e. A dynamic display of the site-specific architecture showing status of the controllers, the ECC and network shall be provided.
  - f. The windowing environment of the workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of graphic associated with an alarm to be viewed without interrupting work in progress.
9. Trend reports shall be generated on demand or pre-defined schedule and directed to monitor display, printers or disk.

## **2.5 NETWORK AND DEVICE NAMING CONVENTION**

### **A. Network Numbers**

- 1. BACnet network numbers shall be based on a "facility code, network" concept. The "facility code" is the VAMC's or VA campus' assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internet work.
- 2. The network numbers are thus formed as follows: "Net #" = "FFFNN" where:
  - a. FFF = Facility code (see below)
  - b. NN = 00-99 This allows up to 100 networks per facility or building

### **B. Device Instances**

1. BACnet allows 4194305 unique device instances per BACnet internet work. Using Agency's unique device instances are formed as follows:
  - "Dev #" = "FFFNNDD" where
    - a. FFF and N are as above and
    - b. DD = 00-99, this allows up to 100 devices per network.
2. Note Special cases, where the network architecture of limiting device numbering to DD causes excessive subnet works. The device number can be expanded to DDD and the network number N can become a single digit. In NO case shall the network number N and the device number D exceed 4 digits.
3. Facility code assignments:
4. 000-400 Building/facility number
5. Note that some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored. Network numbers for facility codes above 400 will be assigned in the range 000-399.

#### C. Device Names

1. Name the control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served. The intent of the device naming is to be easily recognized. Names can be up to 254 characters in length, without embedded spaces. Provide the shortest descriptive, but unambiguous, name. These names should be used for the value of the "Object\_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

### 2.6 BACNET DEVICES

- A. All BACnet Devices - controllers, gateways, routers, actuators and sensors shall conform to BACnet Device Profiles and shall be BACnet Testing Laboratories (BTL) -Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSSs), describing the BACnet capabilities of the Devices shall be published and available of the Devices through links in the BTL website.

### 2.7 CONTROLLERS

- A. General. Provide an adequate number of BTL-Listed B-BC building controllers and an adequate number of BTL-Listed B-AAC advanced application controllers to achieve the performance specified in the Part 1 Article on "System Performance."
- B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed.

## 2.8 SENSORS

- A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.
- B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.
  - 1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral transmitter type for all other sensors.
    - a. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
    - b. Wire: Twisted, shielded-pair cable.
    - c. Output Signal: 4-20 ma.

## 2.9 CONTROL CABLES

- A. General:
  - 1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 26 05 26.
  - 2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
  - 3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
  - 4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
  - 5. Label system's cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.
- B. Analog control cabling shall be not less than No. 18 AWG solid, with thermoplastic insulated conductors.
- C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 5e or 6, not less than minimum 24 American Wire Gauge (AWG) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket.
  1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.
- D. Optical digital communication fiber, if used, shall be Multimode or Singlemode fiber, 62.5/125 micron for multimode or 10/125 micron for singlemode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

#### **2.14 FINAL CONTROL ELEMENTS AND OPERATORS**

- A. Control Valves:
  1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
  2. Valves 50 mm (2 inches) and smaller shall be bronze body with threaded or flare connections.
  3. Valves 60 mm (2 1/2 inches) and larger shall be bronze or iron body with flanged connections.
  4. Brass or bronze seats except for valves controlling media above 100 degrees C (210 degrees F), which shall have stainless steel seats.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. General:
  1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to Resident Engineer for resolution before proceeding for installation.
  2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
  3. Install all equipment and piping in readily accessible locations. Do not run conduit concealed under insulation or inside ducts.

4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plum.

B. Electrical Wiring Installation:

1. All wiring cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit. Install digital communication cables in conduit.
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
5. Install all system components in accordance with local Building Code and National Electric Code.
  - a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
  - b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
  - c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.

- d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
  6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
  7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
  8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.
- C. Install Sensors and Controls:
1. Sensors:
    - a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
    - b. Calibrate sensors to accuracy specified, if not factory calibrated.
    - c. Use of sensors shall be limited to its duty.
    - e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors from contact with metal casings and coils using insulated standoffs.
    - g. All pipe mounted temperature sensors shall be installed in wells.
    - h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
    - i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.
  2. Actuators:
    - a. Mount valve actuators according to manufacturer's written instructions.
    - b. Check operation to confirm that actuator modulates valve smoothly in both open and closed position.

### **3.2 SYSTEM VALIDATION AND DEMONSTRATION**

- A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the contractor is to

perform a complete validation of all aspects of the controls and instrumentation system.

----- END -----

**SECTION 26 05 11**  
**REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.
- C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.
- D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards,

such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
  - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
  - b. Are periodically inspected by a NRTL.
  - c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

**1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
  1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of

notification that service is needed. Submit name and address of service organizations.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

#### **1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COTR a minimum of 15 working days prior to the manufacturer's performing the factory tests.
  - 2. Four copies of certified test reports shall be furnished to the COTR two weeks prior to final inspection and not more than 90 days after completion of the tests.
  - 3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

#### **1.7 VARIATIONS FROM CONTRACT REQUIREMENTS**

- A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall

include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

#### **1.8 MATERIALS AND EQUIPMENT PROTECTION**

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  - 1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
  - 2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  - 3. Damaged equipment shall be repaired or replaced, as determined by the COTR.
  - 4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  - 5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

#### **1.9 WORK PERFORMANCE**

- A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J - General Environmental Controls, OSHA Part 1910 subpart K - Medical and First Aid, and OSHA Part 1910 subpart S - Electrical, in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the Contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  - 2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COTR and Medical Center staff. The work plan must

include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.

3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COTR.
- D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.

#### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working clearances shall not be less than specified in the NEC.
- C. Inaccessible Equipment:
  1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
- D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches,

generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

- B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

#### **1.12 SUBMITTALS**

- A. Submit to the COTR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
  1. Mark the submittals, "SUBMITTED UNDER SECTION \_\_\_\_\_".

2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  3. Submit each section separately.
- E. The submittals shall include the following:
1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
  2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
- F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
  2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
  3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
  4. The manuals shall include:
    - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
    - b. A control sequence describing start-up, operation, and shutdown.
    - c. Description of the function of each principal item of equipment.
    - d. Installation instructions.
    - e. Safety precautions for operation and maintenance.
    - f. Diagrams and illustrations.
    - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
    - h. Performance data.

- i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
  - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the COTR with one sample of each of the following:
- 1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
  - 2. Each type of conduit coupling, bushing, and termination fitting.
  - 3. Conduit hangers, clamps, and supports.
  - 4. Duct sealing compound.
  - 5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

#### **1.13 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

#### **1.14 ACCEPTANCE CHECKS AND TESTS**

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.

**1.15 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

**1.16 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.
- C. A training schedule shall be developed and submitted by the Contractor and approved by the COTR at least 30 days prior to the planned training.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

---END---

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

- A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings and insulation type for each conductor and cable.
      - 2) Splicing materials and pulling lubricant.
  2. Certifications: Two weeks prior to final inspection, submit the following.
    - a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
    - b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
- D2301-10.....Standard Specification for Vinyl Chloride  
Plastic Pressure-Sensitive Electrical Insulating  
Tape
- D2304-10.....Test Method for Thermal Endurance of Rigid  
Electrical Insulating Materials
- D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic  
Pressure-Sensitive Electrical Insulating Tape
- C. National Electrical Manufacturers Association (NEMA):
- WC 70-09.....Power Cables Rated 2000 Volts or Less for the  
Distribution of Electrical Energy
- D. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
- 44-10.....Thermoset-Insulated Wires and Cables
- 83-08.....Thermoplastic-Insulated Wires and Cables
- 467-07.....Grounding and Bonding Equipment
- 486A-486B-03.....Wire Connectors
- 486C-04.....Splicing Wire Connectors
- 486D-05.....Sealed Wire Connector Systems
- 486E-09.....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors
- 493-07.....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cables
- 514B-04.....Conduit, Tubing, and Cable Fittings

**PART 2 - PRODUCTS****2.1 CONDUCTORS AND CABLES**

- A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- B. All conductors shall be copper.
- C. Single Conductor and Cable:
1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
  2. No. 8 AWG and larger: Stranded.
  3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.

4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified.
  - c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit "switch legs", and 3-way and 4-way switch "traveling wires," shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COTR.
7. Color code for isolated power system wiring shall be in accordance with the NEC.

## 2.2 SPLICES

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
  1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped conductors.
  3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:

1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
  4. All bolts, nuts, and washers used with splices shall be zinc-plated steel.
- D. Above Ground Splices for 250 kcmil and Larger:
1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
- E. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

### **2.3 CONNECTORS AND TERMINATIONS**

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be zinc-plated steel.

### **2.4 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

### **2.5 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.
- B. Shall not be used on conductors for isolated power systems.

**PART 3 - EXECUTION****3.1 GENERAL**

- A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
- B. Install all conductors in raceway systems.
- C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
- D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
- G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
- I. Conductor and Cable Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
  - 2. Use nonmetallic pull ropes.
  - 3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
  - 4. All conductors in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- J. No more than three branch circuits shall be installed in any one conduit.
- K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

**3.2 SPLICE AND TERMINATION INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

- B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

### **3.3 CONDUCTOR IDENTIFICATION**

- A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

### **3.4 FEEDER CONDUCTOR IDENTIFICATION**

- A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

### **3.5 EXISTING CONDUCTORS**

- A. Unless specifically indicated on the plans, existing conductors shall not be reused.

### **3.6 CONTROL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

### **3.7 CONTROL WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

### **3.8 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests: Inspect physical condition.
  - 2. Electrical tests:
    - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-

phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.

- b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
- c. Perform phase rotation test on all three-phase circuits.

---END---

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
  - 2. Test Reports:
    - a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COTR.
  - 3. Certifications:
    - a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
- B1-07.....Standard Specification for Hard-Drawn Copper Wire
- B3-07.....Standard Specification for Soft or Annealed Copper Wire
- B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
- 81-83.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- D. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
- 70E-12.....National Electrical Safety Code
- 99-12.....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
- 44-10 .....Thermoset-Insulated Wires and Cables
- 83-08 .....Thermoplastic-Insulated Wires and Cables
- 467-07 .....Grounding and Bonding Equipment

**PART 2 - PRODUCTS****2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.
- D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

## 2.2 GROUND CONNECTIONS

- A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.
- B. Above Grade:
  - 1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
  - 2. Connection to Building Steel: Exothermic-welded type connectors.
  - 3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
  - 4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

## 2.3 GROUND TERMINAL BLOCKS

- A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

## 2.4 GROUNDING BUS BAR

- A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

- C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
- D. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

### **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

### **3.3 RACEWAY**

- A. Conduit Systems:
  - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - 2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
  - 3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
  - 4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.
- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
  - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
- D. Wireway Systems:
  - 1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.

2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
  3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
  4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).
- E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
- H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.
- I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

### **3.4 CORROSION INHIBITORS**

- A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

### **3.5 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

### **3.6 ACCEPTANCE CHECKS AND TESTS**

- A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground

resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

- B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the COTR prior to backfilling. The Contractor shall notify the COTR 24 hours before the connections are ready for inspection.

---END---

**SECTION 26 05 33  
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Size and location of main feeders.
    - b. Size and location of panels and pull-boxes.
    - c. Layout of required conduit penetrations through structural elements.
    - d. Submit the following data for approval:
      - 1) Raceway types and sizes.
      - 2) Conduit bodies, connectors and fittings.
      - 3) Junction and pull boxes, types and sizes.
  - 2. Certifications: Two weeks prior to final inspection, submit the following:
    - a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.

- b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

#### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
- C80.1-05.....Electrical Rigid Steel Conduit
  - C80.3-05.....Steel Electrical Metal Tubing
  - C80.6-05.....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
- 70-11.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- 1-05.....Flexible Metal Conduit
  - 5-11.....Surface Metal Raceway and Fittings
  - 6-07.....Electrical Rigid Metal Conduit - Steel
  - 50-95.....Enclosures for Electrical Equipment
  - 360-13.....Liquid-Tight Flexible Steel Conduit
  - 467-13.....Grounding and Bonding Equipment
  - 514A-13.....Metallic Outlet Boxes
  - 514B-12.....Conduit, Tubing, and Cable Fittings
  - 514C-07.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
  - 651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit
  - 797-07.....Electrical Metallic Tubing
  - 1242-06.....Electrical Intermediate Metal Conduit - Steel
- E. National Electrical Manufacturers Association (NEMA):
- TC-2-13.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
  - TC-3-13.....PVC Fittings for Use with Rigid PVC Conduit and Tubing
  - FB1-12.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
  - FB2.10-13.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate

Metallic Conduit, and Electrical Metallic  
Tubing)

FB2.20-12.....Selection and Installation Guidelines for  
Fittings for use with Flexible Electrical  
Conduit and Cable

F. American Iron and Steel Institute (AISI):

S100-2007.....North American Specification for the Design of  
Cold-Formed Steel Structural Members

## **PART 2 - PRODUCTS**

### **2.1 MATERIAL**

- A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).
  2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and ANSI C80.1.
  3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
  4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
  5. Flexible Metal Conduit: Shall conform to UL 1.
  6. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
  7. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
  8. Surface Metal Raceway: Shall conform to UL 5.
- C. Conduit Fittings:
1. Rigid Steel and Intermediate Metallic Conduit Fittings:
    - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
    - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
    - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
    - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.

- e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical Metallic Tubing Fittings:
    - a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
    - b. Only steel or malleable iron materials are acceptable.
    - c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
    - d. Indent-type connectors or couplings are prohibited.
    - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
  3. Flexible Metal Conduit Fittings:
    - a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
    - b. Clamp-type, with insulated throat.
  4. Liquid-tight Flexible Metal Conduit Fittings:
    - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
    - b. Only steel or malleable iron materials are acceptable.
    - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
  5. Direct Burial Plastic Conduit Fittings: Fittings shall meet the requirements of UL 514C and NEMA TC3.
  6. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
  7. Expansion and Deflection Couplings:
    - a. Conform to UL 467 and UL 514B.

- b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
- 1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
  - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
- 1. UL-50 and UL-514A.
  - 2. Rustproof cast metal where required by the NEC or shown on drawings.
  - 3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.
- F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

### **PART 3 - EXECUTION**

#### **3.1 PENETRATIONS**

- A. Cutting or Holes:
- 1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
  - 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

- B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight.

### **3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, NEMA, as shown on drawings, and as specified herein.
- B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.
- C. Install conduit as follows:
  - 1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
  - 2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
  - 3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
  - 4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  - 5. Cut conduits square, ream, remove burrs, and draw up tight.
  - 6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
  - 7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
  - 8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
  - 9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
  - 10. Conduit installations under fume and vent hoods are prohibited.
  - 11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
  - 12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- D. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

### 3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
  - a. Where shown on the structural drawings.
  - b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
  - a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
  - b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
  - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the same system is prohibited.
2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.

4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.
6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

#### **3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the system is prohibited.
- C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.
- G. Surface Metal Raceways: Use only where shown on drawings.
- H. Painting:
  1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

#### **3.5 HAZARDOUS LOCATIONS**

- A. Use rigid steel conduit only.
- B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

#### **3.6 WET OR DAMP LOCATIONS**

- A. Use rigid steel or IMC conduits unless as shown on drawings.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

- C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.
- D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

### **3.7 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.
- C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

### **3.8 EXPANSION JOINTS**

- A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.
- C. Install expansion and deflection couplings where shown.

### **3.9 CONDUIT SUPPORTS**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of

the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U-bolts or other approved fasteners.

- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
    - b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
    - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### 3.10 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

- C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.
- D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.
- F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
- G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.
- H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

**SECTION 26 27 26**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
  2. Manuals:
    - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
    - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
  3. Certifications: Two weeks prior to final inspection, submit the following.
    - a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.

- b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):  
 70-11.....National Electrical Code (NEC)  
 99-12.....Health Care Facilities
- C. National Electrical Manufacturers Association (NEMA):  
 WD 1-10.....General Color Requirements for Wiring Devices  
 WD 6-08 .....Wiring Devices - Dimensional Specifications
- D. Underwriter's Laboratories, Inc. (UL):  
 5-11.....Surface Metal Raceways and Fittings  
 20-10.....General-Use Snap Switches  
 231-07.....Power Outlets  
 467-07.....Grounding and Bonding Equipment  
 498-07.....Attachment Plugs and Receptacles  
 943-11.....Ground-Fault Circuit-Interrupters  
 1449-07.....Surge Protective Devices  
 1472-96.....Solid State Dimming Controls

## PART 2 - PRODUCTS

### 2.1 RECEPTACLES

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
  2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
1. Bodies shall be ivory in color.
  2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
  3. Duplex Receptacles on Emergency Circuit:

- a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
- 4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
  - a. Ground fault interrupter shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
  - b. Ground Fault Interrupter Duplex Receptacles (not hospital-grade) shall be the same as ground fault interrupter hospital-grade receptacles except for the hospital-grade listing.
- C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

## **2.2 TOGGLE SWITCHES**

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
  - 1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
  - 2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
  - 3. Switches shall be rated 20 amperes at 120-277 Volts AC.

**2.3 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- B. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- C. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
- D. Duplex Receptacles on Emergency Circuit: Wall plates shall be type 302 stainless steel, with the word "EMERGENCY" engraved in 6 mm (1/4 inch) red letters.

**2.4 SURFACE MULTIPLE-OUTLET ASSEMBLIES**

- A. Shall have the following features:
  - 1. Enclosures:
    - a. Thickness of steel shall be not less than 1 mm (0.040 inch) for base and cover. Nominal dimensions shall be 40 mm x 70 mm (1-1/2 inches by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3-1/2 square inches). The enclosures shall be thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard baked enamel finish.
  - 2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this Section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
  - 3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.
  - 4. Conductors shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.
  - 5. Installation fittings shall be the manufacturer's standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.
  - 6. Bond the assemblies to the branch circuit conduit system.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Install wiring devices after wall construction and painting is complete.
- C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.

- D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
- E. Provide barriers in multigang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.
- I. Install wall dimmers 1.2 M (48 inches) above floor.
- J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- K. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.
- L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Inspect physical and electrical condition.
    - b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.

- c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
  - d. Test GFCI receptacles.
2. Healthcare Occupancy Tests:
- a. Test hospital grade receptacles for retention force per NFPA 99.

---END

**SECTION 26 29 21**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, fuses, circuit breakers, wiring and connection diagrams, accessories, and device nameplate data.
  2. Manuals:
    - a. Submit complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering fuses, circuit breakers, and replacement parts.
      - 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the enclosed switches and circuit breakers.

- 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
- 3. Certifications: Two weeks prior to final inspection, submit the following.
  - a. Certification by the manufacturer that the enclosed switches and circuit breakers conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the enclosed switches and circuit breakers have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. International Code Council (ICC):
  - IBC-12.....International Building Code
- C. National Electrical Manufacturers Association (NEMA):
  - FU 1-07.....Low Voltage Cartridge Fuses
  - KS 1-06.....Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- D. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
  - 98-07.....Enclosed and Dead-Front Switches
  - 248-00.....Low Voltage Fuses
  - 489-09.....Molded Case Circuit Breakers and Circuit Breaker Enclosures

**PART 2 - PRODUCTS**

**2.1 FUSED SWITCHES RATED 600 AMPERES AND LESS**

- A. Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.
- B. Shall be NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 480 V switches.
- C. Shall be horsepower (HP) rated.
- D. Shall have the following features:
  - 1. Switch mechanism shall be the quick-make, quick-break type.
  - 2. Copper blades, visible in the open position.

3. An arc chute for each pole.
4. External operating handle shall indicate open and closed positions, and have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
6. Fuse holders for the sizes and types of fuses specified.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground lugs for each ground conductor.
9. Enclosures:
  - a. Shall be the NEMA types shown on the drawings.
  - b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.
  - c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

## **2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

- A. Shall be the same as fused switches, but without provisions for fuses.

## **2.3 MOTOR RATED TOGGLE SWITCHES**

- A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.
- B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

## **2.4 CARTRIDGE FUSES**

- A. Shall be in accordance with NEMA FU 1.
- B. Motor Branch Circuits: Class RK1, time delay.
- C. Other Branch Circuits: Class RK1, time delay.
- D. Control Circuits: Class CC, fast acting.

## **2.5 SEPARATELY-ENCLOSED CIRCUIT BREAKERS**

- A. Enclosures shall be the NEMA types shown on the drawings. Where the types are not shown, they shall be the NEMA type most suitable for the ambient environmental conditions.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.

**3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.
    - d. Vacuum-clean enclosure interior. Clean enclosure exterior.

**3.3 SPARE PARTS**

- A. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver the spare fuses to the COTR.

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